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THE FAR-EASTERN CONFERENCE ON FORESTRY AND TIMBER UTILISATION

THE Far-Eastern Conference on Forestry and Timber Utilisation which has just concluded its session at Mysore is the Third Regional Conference to be organised by the Food and Agricultural Organisation of the United Nations. The first of these was held in 1947 in Czecho-Slovakia to cater primarily to European needs; the second was held in 1948, in Brazil, for the Latin American countries; and now, the third of these, devoted to the problems of the Asian and Pacific countries, has completed its work. It may be added that the *Ecafe* also suggested the convening of the Conference. India offered to be the host and the Government of Mysore provided the necessary facilities at Mysore City which has thus had the privilege of being the venue of the first International Conference in its long history.

Delegates from Burma, Ceylon, France, India, Malaya, Netherlands, New Zealand, Pakistan, Philippines, Siam and the United Kingdom attended the Conference. Observers were present on behalf of Bhutan, Indonesia, Korea, Nepal, Portugal, *Unesco*, *Scap* (Japan), and the International Meteorological Organisation. Russia was a notable absentee. The Indian Delegation was led by Sir T. Vijayaraghavacharya,

and on his later election to the Chairmanship of the Conference, by Mr. A. P. F. Hamilton, I. G. of Forests, whose colleagues on the Delegation were Mr. C. R. Ranganathan and Mr. R. Bhadran. The Delegation was assisted by Dr. S. Kamesam and a number of Chief Conservators of Forests of the Indian Provinces and States as alternate Delegates and Advisers. M. Marcel Leloup, Director of Forestry, FAO, was in general charge of the Conference assisted by Dr. Morris A. Hubermann, Secretary-General, and Dr. D. Y. Lin and Dr. Leslie Vernell, Technical Secretaries. Mr. M. A. Muthanna, Chief Conservator of Forests, Mysore, was, besides his place in the Indian Delegation, in charge of the local arrangements of the Conference.

The general pattern of work for the Conference was on the same lines followed in the two earlier regional conferences, *viz.*, to assess the forest assets and liabilities of each region, to estimate the gap between the supply and the demand for forest products, discuss remedies and to set up machinery and to implement on a regional basis, the recommendations of the Conference.

The Conference for which elaborate preparations had been made by the Governments of India and Mysore opened at the Cheluvamba Mansions, Mysore, on the 28th March 1949. The Hon'ble Mr. Jairamdas Doulatram, Minister for Food and Agriculture, inaugurated the Conference. His Highness the Maharaja of Mysore in his gracious speech expressed his pleasure to welcome such a distinguished international gathering to the capital of the State, referred to the salient features of Mysore Forests and expressed his hope that the deliberations of the Conference would be crowned with success. Pandit Jawaharlal Nehru, Prime Minister of India, expressed his great regret at being unable to be present, and his inspiring message wishing success said, "To the people in the East, as indeed in the whole world, the numerous problems of Forestry hold out a great challenge. It must be met if the world is to be made a better place to live in. Fundamentally, the problems are the same in all countries and I am sure this Conference will not only provide the means of pooling the world's knowledge and experience of Forestry but will also, by bringing together the foresters of the East, strengthen the Brotherhood of Forestry and the bonds of friendship which already exist among the Nations participating. I send my best wishes for the success of the Conference." Mr. Jairamdas Doulatram, in his speech, felicitously indicated how appropriate it was that the first International Forestry Conference was held in India, which led the Asian countries in some aspects of forest technique and administration and whose wise men had turned to and not away forests for spiritual solace. He referred at the unwisdom of planning for agricultural self-sufficiency without adequate protection of the soil. He pleaded for a rational appreciation of the rural and the industrial demands made on forest resources and concluded by freely offering the facilities available in and the results garnered by India in forestry research.

Mr. Norris E. Dodd, Director-General of the FAO, in his message, dwelt on the interdependence of the well-being of the land and the community, while M. Marcel Leloup, Director of Forestry, FAO, explained the magnitude of the problems they had to face in Asia and the machinery needed to translate the recommendations of the Conference.

The Conference, after electing its permanent Chairman, Sir T. Vijayaraghavacharya (India), proposed by Pakistan, seconded by Burma and unanimously elected, decided its rules of business under a steering committee which also acted as the credentials committee. Then, splitting its work amongst a number of expert committees,

resolutions were drafted and, after critical discussion, were finally adopted by the plenary sessions of the Conference, on the following subjects:—(1) Forest Resources; (2) Forest Policy; (3) Soil Conservation; (4) International Control in Erosion Control; (5) Forestry and Weather; (6) Control of Grazing; (7) Roving Agriculture; (8) Large-scale Afforestation and Reforestation; (9) Domestic Needs; (10) Increased Production; (11) Balancing Supplies and Demand; (12) Distribution of Timber; (13) Standardisation and Grading; (14) Forest Inventions; (15) Enumeration Methods; (16) Minor Forest Products; (17) Statistics; (18) Research; (19) Exchange of Information; (20) Dissemination of Information; (21) Training and Education and (22) Conservation of Wild Life.

While considerations of space unfortunately preclude us from reproducing the text of all the resolutions *in extenso*, even the listing of the titles of the subjects dealt with indicate the range and comprehensiveness of the deliberations. This is not surprising, as the preamble and the constitution of the Food and Agricultural Organisation of the United Nations include: raising standards of living, securing improvements in the efficiency of production and distribution and bettering the conditions of rural populations. And, forestry touches so broad a front at many, many points.

The recommendations of the Conference naturally fall into two categories, *viz.*, the immediate needs and the long-term requirements. The former have an element of sameness all over the world. Forests have been cut, in many instances grossly overcut, during the war years in persuance of 'win the war at any cost' policy. In forestry, the first tenet is conservation and conservation is the first casualty in any war. And these over-exploited forest resources are now called upon and provide the accumulated needs and pent up demand of this period of colossal material destruction. And since forest products form part of the goods ranging from aeroplanes to matchsticks, the magnitude and complexity of meeting the needs of a starved world will become clear.

While the Conference took note of these extremely urgent needs and made specific recommendations to meet them, even more valuable was its contribution for the long-term rehabilitation and development of the forest resources of the region. Forestry is, in the best sense of the term, the best of investments but long dated. And, nemesis for lapses in forestry is not always swift or readily visible but terribly sure. These characteristic elements of forestry make it peculiarly difficult for uninitiated public opinion to appreciate or sometimes even recognise the implications of indifferent forest management. The temptation to cash in now the forest benefits that rightly belong to posterity is always there; and to index and measure the apparent efficiency of forest management by the fallacious yardstick of immediate financial return. These are matters of such grave import that the Conference rendered signal public service in dealing with them in its first resolution which reads as follows:

"The Importance of Forest Resources.

"The Conference,

"Recognising, that forests, as renewable, are essential to a country's agricultural life, industrial development, economic stability and national security;

"Recognising also, that forests and forest products both major and minor are essential to the life of the rural and urban population;

"Calls the attention of the governments of all countries of the region to the need for dynamic policies for the conservation, development and utilisation of forest resources, according, to the needs and possibilities of each country;

"Declares that any failure by governments to accord due recognition to the great value

of forest resources will have disastrous consequences for the economy of the country, both rural and industrial;

"Urges governments so to manage their forests as to serve the rural and urban population and thus enlist the support of the masses for the implementation of a sound policy for the protection and development of forests, even though this may involve some restriction on the action of individuals in the interests of the community as a whole. Thus the precious heritage of forest resources can be passed on unimpaired from generation to generation;

"Recommends that the attention of the governments of the region be drawn to the desirability of giving a high priority in their national financial and economic plans to the claims of forestry and the improvement of harvesting facilities."

We should like to draw attention to three other resolutions passed at the Conference and of special importance to India.

Resolution III deals with the menace of soil erosion and recommends, *inter alia*, the setting up in each country a central authority for the co-ordination, in both planning and execution, of land utilisation policies. The pressure on land of population, the planning and construction of vast irrigation and multipurpose River projects and the fact that in a vast country like ours the watercourses of many of these rivers lie within the control of different provincial authorities render it imperative that we have recourse to some central authority in such matters if the insidious and terrible chain of events consequent upon soil erosion is to be insured against. Also, even within a given province, the clamour for land cultivation at the expense of forest lands is a development which must be sternly put down. Taking the country as a whole, the area under forest is well below the safe minimum of about 25 to 30 per cent. of the land area, and it would be very short-sighted policy indeed if our effort at self-sufficiency in food should make inroads into our already inadequate forest areas—losing sight of the basic fact that forestry and agriculture are two different methods of utilising the common capital of both, *viz.*, the soil.

Resolution XVIII makes recommendations on the important subject of forest research. This is an important aspect of forestry in which this country has good reason to take modest pride but no ground whatever to be complacent. Dehra Dun is on the international map of forest research centres. But, the point is that while Dehra Dun is good, it is not alone sufficient to cover the needs of this vast country. Dehra Dun should be the focal point from which the traditions and experience of this premier institution should permeate a number of co-ordinated regional research centres strategically located over this subcontinent. It is pleasant to record that the Indian offer to co-operate fully by placing her available research facilities and experience at the disposal of the member nations at the Conference was appreciated.

Finally, we should like to refer to the question of forest education which is dealt with in Resolution XXI. Here again, what we have is undoubtedly good but demonstrably insufficient. And there are many who believe that forest education in India is much too expensive. The Indian Delegation made a positive contribution to the deliberations of the Conference on this subject. All our plans and machinery for forest education have been hemmed in by two considerations, to provide professional foresters, and to provide such professional foresters to man the forestry services—almost exclusively governmental. The time is now ripe to loosen these restrictive bonds. The ideal to be aimed at would be that while first-rate facilities should continue to be available to train the professional forester, we should also establish educational facilities whereby elementary forestry may take its due place as a subject of liberal education in the curricula of universities. Finland

presents a fine example of what could be done in this direction. Then, again, the forests are getting to be increasingly important as the store-house of industrial raw material to be *processed* into consumer goods. This trend has created a demand for the services of the specialist who, with a grounding in the fundamentals of forestry, is called upon not to manage forests, but run forest industries. The facilities for such specialised training are conspicuous by their almost total absence in our country. And, here, the U.S.A., Canada and Germany could give us valuable lessons.

The fact that such packed agenda was disposed of within the course of some eleven working days was a tribute as much to the efficient and business-like organisation and the preparatory technical work as to the ability, tact and genial personality of the distinguished Chairman, Sir T. Vijayaraghavacharya, to whose work a chorus of tribute was paid by the delegates at the close of the Conference. The Conference was also fortunate in another respect. It was singularly free from rivalries and 'lobbyings' which make some international gatherings a nightmare. Foresters naturally form a fraternity; they fell, with axes but have no axes to grind and no secrets to jealously guard against prying eyes and ears. They are ready indeed anxious to share their experience and to pool their knowledge. All this contributed to the amity and dignity of the international gathering.

As a postscript, it may be added that one immediate and concrete sequel to this Conference is the setting up of a regional forestry office at Bangkok, with Dr. D. Y. Lin as its first Director. The Indian Delegation strongly urged the claims of India for the location of this office both on geographical grounds and on the basis of past experience and the great facilities for research which India affords. We are naturally disappointed that the verdict of the Conference in this matter went against India, but, this by itself is not a serious matter and we wish every success to the new offiice and its distinguished Director at Bangkok in the discharge of their responsible duties in the service of Forestry.

BRITISH INDUSTRIES FAIR

THE biggest trade fair in the world—the British Industries Fair—to which thousands of visitors and buyers flock from all parts of the world, will be held this year at London and Birmingham from May 2 to May 13.

Representative of all trades and industries in Britain, this year's Fair is expected to surpass all previous exhibitions in the quality, range and beauty of its exhibits.

India's interest in the British Industries Fair of 1948 was, in comparison to other countries, markedly high. Over 700 buyers attended the London section alone in a total of 12,505 buyers from nearly 100 countries. And the coming Fair is likely to attract even more buyers from India.

The lighter industries will exhibit in London, while the Engineering and Hardware Section will be organised, as usual, in Birmingham.

The 1949 Fair will include a major display by the Textile and Clothing industries and is expected to be the best exhibited so far. Other industries exhibiting in London will include brushes and brooms, chemicals, chemists' supplies, cutlery, jewellery, plated ware, silverware, watches and clocks, domestic suction cleaners, fancy goods of all types, foodstuffs, beverages and tobacco, furniture, leather and leather goods, musical instruments, office machinery and equipment, plastics, pottery and glassware, printing and bookbinding machinery, radio sets and allied trades, scientific and photographic equipment, sports goods, stationery and paper, toys and games and other general and sales services.

At Birmingham, the buyer will find every conceiable item of equipment needed for the building trade, for electricity and engineering of all categories, for transport, for gas, for mining, colliery, road and oilfield. There will be a section for hardware, ironmongery and brassfoundry and also metals of all types—in fact everything that India needs for building up her own industries and modernising her state.

PROFESSOR ALBERT EINSTEIN—THE INTERNATIONALIST

PROFESSOR NIELS BOHR

IT is most natural and appropriate that the United Nations Educational, Scientific and Cultural Organization should pay a tribute to Albert Einstein on the occasion of his seventieth birthday. Indeed, for the whole of humanity Einstein's name stands pre-eminently for that search to extend our knowledge and deepen our understanding which is not only the spirit and object of science, but which forms the very foundation of all human civilization.

Through Albert Einstein's work the horizon of mankind has been immeasurably widened, at the same time as our world picture has attained a unity and harmony never dreamed of before. The background for such achievement is created by preceding generations of the world-wide community of scientists and its full consequences will only be revealed to coming generations.

Man's endeavours to orient himself in his existence beyond the immediate necessities of life may be traced back to the widely spread birth-places of our civilization like Mesopotamia, Egypt, India and China and, above all, to the small free communities in Greece, where arts and science rose to a height unsurpassed for long ages. During the Renaissance, when all aspects of human culture again flourished, most intense and fruitful contacts between scientific endeavours all over Europe took place, as we are reminded by the names of Copernicus, Tycho Brahe, Kepler, Galileo, Descartes, Pascal and Huygens, men of many countries whose achievements created the basis of the edifice of which Newton's genius is the pinnacle.

New Insight

The great advance of natural philosophy at that time, which came to exert a deep influence on all human thinking, consisted above all in the attainment of a rational description of mechanical phenomena based on well-defined principles. It must, however, not be forgotten that the idea of absolute space and time formed an inherent part of the basis of Newton's work and that also his well-known concept of universal gravitation constitutes an element so far not further explainable.

It was just at these points that Einstein initiated quite a new development which, in an unforeseen manner, has deepened and rounded our views and given us new insight and power of comprehension.

The way leading to this turning point was paved by the development during the nineteenth century, of our knowledge of the electromagnetic phenomena which has brought such a great increase in human facilities and created the modern means of world-wide communication.

This development was furthered by an ever more active international co-operation, the extent of which is recalled by such names of many nations as Volta, Cersted, Faraday, Maxwell, Hertz, Lorentz and Michelson. Gradually, however, the growth of knowledge in this new field disclosed more and more clearly the difficulties and paradoxes inherent in absolute space-time description.

A quite new outlook was here opened by the genius of Einstein, who changed the whole approach to the problems by exploring the very foundation for the description of our experience. Thus, Einstein taught us that the concept of simultaneity of events occurring at different places was inherently *relative*, in the sense that two such events which to one observer appear simultaneous, may seem to follow each other in time from the standpoint of another observer.

This recognition of the extent to which the account of phenomena depends essentially on the motion of the observer proved, in the hands of Einstein, a most powerful means of tracing general physical laws valid for all observers.

In the following years, Einstein even succeeded in attaining a view-point wide enough to embrace the gravitational phenomena, by extending his considerations to the comparison of the effects experienced by observers with accelerated movement relatively to each other. Out of Einstein's novel approach to the use of space and time concepts grew gradually a wholly new attitude towards cosmological problems, which has given most fertile inspiration for the exploration of the structure of the universe.

Although simplicity and beauty are the principal marks of Einstein's fundamental ideas, the detailed treatment of complex problems often demands the use of abstract mathematical methods like non-Euclidean geometry. As often before, it has here been most fortunate that such tools were ready as the fruit of the work of older mathematicians.

The names of Gauss, Lobachevsky, Bolyai, Riemann, Ricci and Minkowski here again remind us of the fertility of international co-operation in all fields of science. And the same may be said of Einstein's other outstanding work.

For example, his explanation of the irregular motion of small bodies in liquids, based on the ideas of Maxwell, Boltzmann, Smoluchowski and Gibbs, made it possible for Jean Perrin accurately to count the atoms of which substances are built.

We find ourselves to-day in a new epoch in physical science, in which experimental discoveries and theoretical methods have led to a rapidity and fecundity of progress made possible only by international co-operation of an unprecedented activity and extent.

It is not possible in this occasion to disentangle the contributions of individual workers, but mention must be made of the guidance, at almost every step, which Einstein has given us by his Relativity theory and by his analysis of elementary quantum phenomena.

Altogether, this short exposition of Einstein's scientific achievements aims at giving an impression of the extent to which his originality of outlook has made him an innovator in science. At the same time, I have attempted to remind you that all scientific endeavours are parts of a great common human enterprise.

The gifts of Einstein to humanity are in no way confined to the sphere of science. Indeed, his recognition of hitherto unheeded assumptions in even our most elementary and accustomed concepts means to all people a new encouragement in tracing and combating the deep-rooted prejudices and complacencies inherent in every national culture.

With his human and noble personality, characterized equally by wisdom and humour, Einstein himself has through all his life, and not least in these latter years, worked for the promotion of international understanding. On his seventieth birthday evidence of the veneration and gratitude our whole generation owes to him will reach Einstein from many sides, and we all want to express the wish that the hopes for which he has lived and worked may be fulfilled to the benefit of all mankind.

—By courtesy of Unesco "Courier", *March*, 1949.

INDIAN SOCIETY OF AGRICULTURAL STATISTICS

A NEW organisation, the Indian Society of Agricultural Statistics, has been formed. The Society is devoted to the 'Study of and research on, Statistics and applications thereof to Agriculture, Animal Husbandry and Agricultural Economics'. The Society is open to all persons and institutions interested in Statistics and its application. Membership fee per annum is Rs. 18/ in India and Rs. 20/ outside.

The first Journal of the Society published in Jan. 1948 contains many useful contributions, technical and non-technical, with brief summaries in Hindi language. The Minister for Food and Agriculture and the Minister for Finance, Government of India, have in their addresses expressed great anxiety of the Government of India to improve the statistical organisation in India. Dr. Sukhatme's article on crop-surveys should convince the Governments about the utility of modern statistical methods in crop-estimation work. The fact that the duty of collection and interpretation of data should be entrusted to the technically trained is obvious from the several articles appearing in the Journal.

Contributions on the statistical theory by Messrs. R. D. Narain, Panse and Bokil and Kishen show that this Journal is in no way inferior from the technical point of view to the best of the American and British Journals. The Editors of the Journal, Dr. P. V. Sukhatme and Dr. V. G. Panse, deserve to be congratulated.

We sincerely welcome the Journal and join the Editors in appealing to Government, Universities, Research Institutes and the public to extend their fullest co-operation and generous support.

DIETETIC HEPATIC LESIONS AND PROTEIN DEFICIENCY*

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AS a result of recent researches, a new orientation has been given to the etiology and treatment of liver diseases in general and 'cirrhosis of liver' in particular. Experimental evidence has accumulated to suggest that 'cirrhosis of liver' may be a deficiency disease. Malnutrition is widely prevalent in India and the incidence of 'cirrhosis of the liver' is fairly high in certain parts of the country. It was pointed out by the senior author (1936) that "dietetic deficiencies appear to be the important factors in the causation of the disease".

In view of its practical importance, a study of 'cirrhosis of the liver' both in its clinical and experimental aspects of the problem, was undertaken under the auspieces of the Indian Research Fund Association, in the Haffkine Institute, Bombay, since July 1944.

Experimental work was designed to study the effect of protein deficiency, with and without supplements of the vitamins of the B_2 complex on the histological and biochemical changes in the liver of rats, while the clinical investigation was mainly concerned with the evaluation of the effect of treatment of decompensated portal cirrhosis with high protein, high caloric diets with vitamin supplements.

1. Experimental Hepatic Cirrhosis

(a) *Effect of Vitamin B_2 Complex deficient diet with different levels of protein on the liver:* Casein was the main source of protein and the basal diets contained varying levels of the protein, namely 18, 10, 8 and 5 per-cent. casein respectively. Animals in this group were deprived of all the vitamins of the B_2 complex. A total of 108 rats were used in this experiment in the different groups.

The growth and survival of the rats depended largely on the amount of casein in the diets. On the 5 per cent. casein diet, the animals did not survive for more than 2 to 3 months. In the other groups, the average life of the animals increased as the casein in the diet was raised.

The relationship between liver weight and body weight of the rats was found to vary according to the level of casein in the diets. In general, as the percentage of casein in the diet was decreased, the average liver weight per 100 g. body weight was increased.

The estimation of water, fat and protein content of the liver showed that this increase in the weight of the livers in the low protein groups was not due to accumulation of fat alone; for, there were significantly larger amounts of water and protein present as compared to normal liver.

(b) *Histological findings:* In animals receiving 18 to 10 per cent. casein diets respectively, the liver parenchyma showed moderate to severe fatty infiltration, particularly around the central veins. Traces of ceroid pigment was also visible in these areas. In the 8 per cent. and 5 per cent. groups, extensive fatty infiltration, more marked around the central veins was seen. An interesting feature in the 8 per cent. protein group was the appearance of replacement fibrosis, patchy in distribution around the central veins. In certain cases this was more marked and there was a tendency for the formation of pseudolobules. Animals receiving 5 per cent. protein diet did not show any marked replacement fibrosis. None of the animals in any group showed massive necrosis.

(c) *Control diets:* The composition of these diets was similar to the above and likewise the level of casein in diets varied from 5 to 18 per cent. respectively; the only difference being that each animal received in addition 0·5 g. of dried brewer's yeast per day as a source of the vitamins of B group.

In this group there was no significant difference in the amount of water, fat and protein content of the liver, except in the 5 per cent. group which showed slight increase in the water and fat content.

Histological findings

Animals receiving 18 and 10 per cent. casein diets with supplements of yeast showed normal structure of the hepatic parenchyma, while those receiving 8 and 5 per cent. casein showed slight fatty infiltration around the central veins. Fibrosis of

* A paper read before the Medical and Veterinary Section of the 36th Session of the Indian Science Congress, held at Allahabad in January 1949.

the liver was altogether absent in these groups of animals even after prolonged feeding of the diets.

2. Effect of restricted intake of protein [casein] in an otherwise adequate diet on the histological and biochemical changes in the liver of rat.

An interesting feature of the previous experiment was the absence of massive necrosis of the liver on protein-deficient diets. Himsworth and Glynn (1944) however, have claimed to have produced massive hepatic necrosis and its sequence in rats by limiting the intake of casein between 200-500 mg. per rat per day. They found that the amount of fat, carbohydrate, minerals or vitamins in the diet did not have any influence on the production of hepatic necrosis

It was therefore thought worthwhile, to study the histological and biochemical changes in the liver of rats on restricting the daily casein intake at different specific levels in an otherwise adequate diet.

The average results are given below :—

Daily casein intake	Initial weight in g.	Final weight in g.	Calories in take	Liver wt. g./100 g. body wt.	Water g./100 g body wt.	Fat g./100 g. body wt.	Protein g./100 g. body wt.	Ash g./100 g. body wt.
(*a*) 1·2 g.	37·8	170·3	32·66	3·24	2·28	0·17	0·65	0·05
(*b*) 0·6 g.	37·5	149·5	28·6	2·87	2·04	0·17	0·55	0·04
(*c*) 0·4 g.	36·0	139·0	26·7	3·16	2·19	0·31	0·51	0·04
(*d*) 0·2 g.	38·8	89·0	19·3	4·16	2·81	0·48	0·65	0·05

The experiment was continued for more than 150 days. The growth of the animals paralleled the daily casein intake. The animals receiving a maximum of 1·2, 0·6 and 0·4 g. casein daily were quite healthy and normal and there were no signs of vitamin deficiency in any case, whereas those receiving a maximum of 0·2 g. casein showed considerable emaciation, loss of hair over the body and in general appeared weaker. There was no edema or ascites in any case.

From the results of the liver analysis given in the above table, it will be seen that the liver weight per 100 g. body weight shows a definite increase as the daily intake of casein was reduced. The amount of liver fat per 100 g. body weight also showed an appreciable increase as the intake of casein was progressively reduced.

The results of the total plasma protein concentration and the choline content of the liver of rats in the different groups are shown below :

Daily protein (casein) intake	1·2 g	0·6 g.	0·4 g.	0·2 g.
Total plasma protein g./100 c.c. plasma	6·83 g.	6·11 g.	5·52 g.	4·81 g.
Liver choline content mg./g. of fresh liver tissue	2·14 mg.	1·89 mg.	1·43 mg.	1·55 mg.

The total plasma protein concentration shows a definite decline as the daily intake of casein is reduced and the liver choline content also shows a similar fall.

Histology

On microscopical examination, the liver in animals which received 1·2 and 0·6 g. of casein per rat per day showed no pathological changes. Animals which received 0·4 and 0·2 g. of casein per rat per day, on the other hand, showed slight fatty change of the hepatic parenchyma around the central veins. But, in marked contrast to the animals in the low protein groups which were deprived of vitamins of B_2 complex, none of the animals in this group showed marked fatty change in the hepatic parenchyma around the central veins, accumulation of ceroid pigment or diffuse hepatic fibrosis.

3. Clinical Experiments

In addition to our experimental work, clinical treatment of decompensated portal cirrhosis cases with high protein, high caloric diets with vitamin supplements formed an important part of our studies on the 'cirrhosis of the liver' and this investigation was carried out in collaboration with Dr. N. J. Modi, M.B.B.S., M.R.C.P. (Lond.), in the medical unit of the Goculdas Tejpal Hospital, Bombay.

Twenty patients were treated with high protein diets which included skimmed milk powder, egg protein, fresh milk and casein hydrolysates. Vitamin supplements were given in the form of yeast tablets with injections of vitamin B_2 complex and liver extract in some cases. The majority of the patients come from the poorer classes and their dietary histories revealed gross deficiency in calories, protein and vitamin intake. Ten out of the twenty cases gave history of having had attacks of malaria. Nine cases were addicted to alcohol. Past

history of dysentery was present in four cases and jaundice in only two cases.

The presenting symptom of all patients was enlargement of abdomen, varying in duration from 15 days to two years. All the cases showed evidence of fluid in the abdomen. Spleen was enlarged in eight cases and liver was found enlarged in four cases only. The level of serum proteins was estimated before, during and after treatment as this afforded an objective evidence of the course of the disease. Total protein, albumin, globulin and euglobulin content of blood serum was estimated.

A common observation in all the patients before treatment was the fall in albumin and rise in globulin fraction of the serum proteins thus showing an altered albumin/globulin ratio from the normal. In the globulin fraction, the Euglobulin showed marked increase.

The period of observation during treatment was on an average 5 to 6 months. The results of therapy at the hospital have been quite encouraging. Patients treated with high protein diet showed definite clinical improvement. Ascites, edema and other manifestations of the disease disappeared in many instances. Clinical improvement was attended with a change in the serum protein level towards normal values.

A detailed account of these investigations will be shortly published elsewhere.

We wish to thank Major-General Sir Sahib Singh Sokhey, Kt., Director, Haffkine Institute, Bombay, for his constant encouragement and keen interest in this work.

1. Radhakrishna Rao, M. V., "Monograph on Cirrhosis of the Liver in Northern Circars—South India," *J. Ind. Med. Assoc.* (Dec. 1936; Jan.—July 1937). 2. Himsworth, H. P., and Glynn, L. E., *Clin. Sc.*, 1944, **5**, 93-123 (1944).

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ORGANOLITES IN INDUSTRY

ADDRESSING the members of the Research Club, Kanpur, Dr. M. S. Bhatnagar said that Way first of all discovered the phenomenon of ion-exchange in inorganic substances like clay, silica, etc. Barrell gave the name of organolites to ion-exchanges got from synthetic resins. In 1935, Adama and Holmes working under G. T. Horgan, indicated the possibilities of using these synthetic resins for ion-exchange purposes. He prepared some cation and anion exchange resins from tannin barks and aromatic amines respectively. He found out that monohydric phenols cannot be used for the above purposes, but later on Sir Bhatnagar and his co-workers showed that ion-exchange resins can also be made from ordinary carbolic acid. These resins are of two types: (*a*) Cation exchange and (*b*) Anion exchange. Further, there are two types of cation exchangers—(*i*) having a strong acidic group like SO_3 and (*ii*) having a weak acidic group like carboxylic. The first one can be used for removing the cations from salts of both weak and strong acids while the second is useful only in removing the cations from salts of weak acids. These resins have as many applications as the types they can be made.

Continuing, Dr. Bhatnagar said that the cation exchangers are used for softening water and removing inorganic substances from sugar juice, apple and citrus fruit juice, dilute solutions of gelatin, etc. These juices are first passed through a cation exchanger which removes the metallic ion and later on, an anion exchanger removes the acid. Thus hard water can be very easily softened and also citric and lactic acids can be recovered. The most important contribution of these resins is in the purification of antibiotics like penicillin from moulds and in purification of alkaloids.

HAFFKINE INSTITUTE OF PREVENTIVE MEDICINE, BOMBAY

THE Report for the period 1944-46 is a record of all-round activity. Owing to the impact of war the Institute had to assume various functions which were not in its usual programme. Substantial contribution to medical research in the direction of improvement in prophylactic vaccine, antitoxin serum, antivenene, etc., has been made during the period under report. The scope and activities of the department of chemotherapy was considerably expanded. The Report has been divided into Part I—General and Part II—Research. Among the essential features of the report a few may be cited.

1. *Cholera Vaccine*—Casein hydrolysate direct cholera vaccine was developed during the period. This vaccine was found to possess ten times more protective value than the standard agar grown vaccine. A new method for assessing active immunity in cholera was developed using white mice as test animal. When prepared under controlled digestion process the Muiller and Johnson's casein hydrolysate medium is protein free and the plague vaccine made in this medium was found to retain its protective power even when stored at 37° C. for 18 months. This vaccine is much less toxic to mice than the previous vaccine.

2. *Serum*—Anti-human horse serum was found to prevent allergic and anaphylactic reactions. This was demonstrated in field trials on plague patients treated with anti-plague serum to which 5 gm. of dried anti-human serum was added to 1 litre of anti-plague horse serum.

In the preparation of antivenene a method was developed by which a highly potent polyvalent serum against all the four kinds of snake venom of cobra, krait, Russell's viper and Echis was obtained by injecting horses with a mixture of all the four venoms. The technique of lyophilising has been utilised in the preservation of antitoxin and antisnake venom sera. Now antivenene is issued in dried form in which it can be stored in any rural dispensary so that in case of emergency it can be made readily available and can be used for injection by dissolving in sterile distilled water. This is a remarkable achivement for this country where snake bite is so common and the absence of properly equipped storage condition made it difficult or imposible to make use of the benefit of the antivenene in most cases.

3. *Chemotherapy* — Remarkable success has been obtained in reducing plague mortality to a negligible level by the use of streptomycin, sulpha-diazene and sulpha merazine and sulpha methazine. Pilot plant production of the sulpha drugs has already been established. The Report also contains verious other important and instructive information for those interested in medical research.

The authorities of the Institute deserve praise for such a valuable record of work.

5th *March* 1949. K. P. MENON.

INDIAN JOURNAL OF HELMINTHOLOGY

WE are very happy to welcome the *Indian Journal of Helminthology* being the official organ of the Helminthological Society of India.

While some may contend that there are far too many biological journals in India for all of which the right type of material is scarcely available, we feel that the want of a journal on applied zoology was long felt and the *Indian Journal of Helminthology* gives a large fillip to helminthological workers in India who had to seek hospitality elsewhere for their research publications. In the first issue (October 1948), which has just reached us, all the articles (except one) are from the Lucknow School of Helminthology working under the inspiring guidance of its chief, Prof. G. S. Thapar who is also the Editor of the Journal.

The articles are of a high standard and like its contemporaries in other branches of science, the get-up of the journal is very good.

The journal is published biennially and each issue is priced Rs. 5.

We wish it all success.

A RE-EXAMINATION OF SOME ASPECTS OF PURANAS AND ARCHAEANS OF SOUTH INDIA*

PIONEER geologists such as C. Æ. Oldham, Robert Bruce Foote, William King, C. S. Middlemiss and T. H. Holland traversed large tracts of Peninsular India and carried out reconnaissance survey and have given us the results of their observation in several publications of the Geological Survey of India which constitute classics in the geological literature of Peninsular India. Considering the undeveloped nature of the country, the absence of communications and facilities for work in those times, we cannot but marvel at the valuable contribution of these great pioneers in the realm of field geology. Recent work has however necessitated our re-examining some of their conclusions. In putting forward views divergent from those of the early pioneers like King or Foote or Holland, I wish to state that no disparagement is intended to their classical contributions.

The Purana Group: Bhima Series—A Reclassification

In his Memoir on the South Maharatta country, Bruce Foote recognised a group of unmetamorphosed shales and limestones in parts of Gulbarga District in Hyderabad State and in the contiguous parts of Bijapur District, Bombay Presidency, occurring in the Bhima-Kistna doab and King gave them the name "Bhima Series" and correlated them on lithological grounds to the Kurnool formations, from which they are separated by a vast stretch of Archæan rocks. He divided the Bhimas into a lower series consisting of conglomerates, sandstones, and shales, and an upper series, of limestones.

During a revision survey of Gulbarga District between years 1935 and 1941, an area of over 2,000 square miles of the Bhima Series was covered. One of the important results of this revision work is the recognition of a threefold division of the Bhima Series as against the twofold division given by Bruce Foote. The Lower Bhima Series consisting of basal conglomerates, sandstones, and shales, are 250 feet in thickness, the middle Bhima Series comprising of limestones, accounting for 550 feet, and the Upper Bhima Series, made up of local sandstones, shales, and flaggy limestones have a thickness of 325 feet.

Two dolerite dykes cut through the limestones of the Lower and Middle Bhima Series, and run for some miles. This observation gains importance from the fact that Sir L. L. Fermor distinguished only two groups of basic dykes prior to the Deccan Traps, one contemporaneous with the Dharwar system and the other younger than the Cheyair stage of the Cuddapahs.

The Palnads

The age of the Palnad Series north and south of Kistna in the districts of Guntur in Madras Province, and Nalgonda in the Hyderabad State, was a matter of controversy between two of the pioneers of South Indian Geology, namely, King, and Bruce Foote. King was of the opinion that they were of Kurnool age, whereas Foote was inclined to the view that they might be classified with the Kistna beds which are the uppermost of the Cuddapah system. The reason for this controversy was the absence of a recognisable unconformity between the Kistnas and Palnads in the area covered by them.

We have adduced evidence on structural, lithological and chemical grounds, to show that there is a clear disconformity between the Cuddapahs and the Palnads in the taluks of Narasaraopet, Vinukonda and Guruzala, in Guntur District. Lithologically and chemically these show the closest similarity to the Narji limestones, which are of undoubted Kurnool age, to the Bhima limestones and to the Sullavoi limestones, which have been correlated to the Kurnools. In contrast to the Palnad limestones, the Cuddapah limestones generally give lower values for calcium carbonate, and greater values for magnesium carbonate.

There does not seem to be any formidable difficulty from the available field and laboratory evidence in considering the Palnads as homotaxial with the Kurnools and later than the uppermost Cuddapah beds and separated from the latter by a recognisable disconformity. Much work, however, remains to be done systematically in this area.

* Abstract of the Presidential Address delivered by Prof. C. Mahadevan, to the Geology and Geography Section of the Indian Science Congress, Allahabad, Jan. 1949.

The Pakhals

King, in his Memoir on the Pranhita-Godavari valley, recognised certain sedimentary formations in the neighbourhood of Pakhal village adjacent to a lake of the same name, and at Sullavoi, further north-west. King correlated the Pakhals with the Cuddapah group and the Sullavois with the Kurnool series. He recognises, however, that the correlation of the subdivision of rocks with the groups of Cuddapah series has not been possible.

In the years 1941-44 I had the opportunity of mapping major parts of Sheets 65 C/NW and C/NE and studying in detail the geology of the area.

I venture to suggest that the Pakhals are not homotaxial with Cuddapahs but correspond to the Middle Dharwars comparable to the Gangpur series of Dr. M. S. Krishnan for the following reasons :

1. Nowhere have we seen an unconformity between the Pakhals and the granites.

2. The Pakhals dip at high angles and show folding and pitching and the sediments have been metamorphosed to micaceous garnetiferous phyllites and mica schists with garnets, staurolites, andalusites, chiastolites and kyanites, garnetiferous and micaceous quartzites, tremolite-actinolite schists and marbles, a feature never known to occur in the Cuddapahs.

3. Lithologically, the Pakhals are most dissimilar to the Cuddapahs and afford no comparable correlation, as admitted even by King.

4. The granites are distinctly intrusive into the Pakhals, producing widespread contact effects, whereas the Cuddapahs rest unconformably over the granites, as is evident all along the junction.

Are the Pakhals Homotaxial with the Khondalites ?

In the Pakhals we meet with micaceous schists, garnetiferous phyllites, mica-garnet-staurolite schists, mica-garnet andalusite schists, mica-garnet-kyanite schist, carbonaceous phyllites and marbles. It appears that the same type of rocks when subjected to higher grade of metamorphism give rise to rock-formations extraordinarily similar to the khondalites. We are probably, therefore, justified in considering that the Pakhals are only a less metamorphosed facies of the Khondalites and that both belong to the middle Dharwars.

Age of the Kaladgis

The Kaladgi Series occurring in Bombay Presidency were considered by Bruce Foote to be homotaxial with Cuddapahs mostly on lithological grounds. Recently Dr. L. A. N. Iyer from the Geological Survey of India in his interesting paper on the Geology of South Ratnagiri has noted clear evidence of the intrusion of granites, basic and ultrabasic rocks into the Kaladgis. Just as in the case of Pakhals it appears that the Kaladgis, at any rate a major part of them, are of Dharwar age.

Archæans: Khondalites and Associated Rocks

Dr. M. S. Krishnan has drawn attention to the much needed correlation of the various types of garnetiferous paragneisses of South India and has suggested that the term khondalite originally applied by T. L. Walker to these rocks in the Kalahandi State may be extended to the Bezwada gneisses of Foote and King, the Kailasa gneisses and the Vizianagaram gneiss of King as also the garnetiferous gneisses generally associated with the charnockites in the southern districts of Madras Presidency. The Schistose series of Gudur area consist of garnet-mica schists, with kyanite and staurolite. The Nellore mica belt is on the same strike as the khondalites and there is every reason to suppose that it is merely the continuation of the khondalite zone.

Summary

An effort has been made in this address to show that the Bhimas may be divided into three groups, namely, Lower, Middle and Upper, that basic igneous activity continued upto the Kurnool stage in South India; that the Palnads are comparable to the Kurnools in stratigraphic position and that the Pakhals and Kaladgis are not of Cuddapah but of Dharwarian age. The khondalites are only a more metamorphosed phase of these Pakhals.

As regards the khondalites, an attempt has been made to correlate the paragneisses of South India with the khondalite group. That some of the Dharwars of South India such as those of Nellore are merely the schistose facies of the khondalites has also been shown.

A new vista of economic possibility is opened up as a result of this attempted classification of the stratigraphy of some of the members of the Puranas and Archæans in Peninsular India.

SOIL-BORNE PLANT DISEASES AND THEIR CONTROL*

ECONOMIC stability and prosperity of our newly constituted motherland is closely linked up with scientific growth and development of agriculture, and we in this Section have to play an important role in the work connected with it. It is the national duty of those concerned with it to strive their best to promote food production.

In India yields are lower than in other countries even in normal times and are further depressed by diseases. Losses on this account have been estimated in the neighbourhood of 10 per cent. which can be averted by application of suitable control measures. A considerable portion of such heavy losses is due to the soil-borne pathogens and, in order to prevent these losses, it is essential to obtain full knowledge about the life-history of the pathogens and their behaviour under controlled conditions, so that they may be attacked at the most susceptible stage of their life-cycles. The activity of a soil-borne pathogen forms only a part of the highly complex associations of living organisms most of which are non-pathogenic. A striking example is that of *Fusarium udum*, the pigeon-pea wilt organism, the growth of which has been found to be adversely affected by *Bacillus subtilis* commonly present in the soil. The population of micro-organisms in the soil attains a state of equilibrium by the continued prevalence of a uniform set of conditions and even a slight variation in these conditions may upset this balance, and affect the number and types of soil microflora. We may, therefore, by adjusting the prevailing agricultural practices be able to change the microbial setup in such a way as to adversely affect the parasitic activity of an organism in the soil.

It is, however, essential to have a sound knowledge of the interrelationship of the individual factors and the pathogen. The conditions under which different soil-borne pathogens flourish are fairly wide. Many of the organisms are highly aerobic and therefore flourish in light soils, but there are others which flourish in comparatively heavy soils. Such parasitic fungi as *Fusaria* responsible for wilt diseases flourish at comparatively high soil temperatures, but there are others like *Phytophthora infestans* which are restricted to low temperatures and are extremely sensitive to fluctuations in temperature. A reasonably high moisture content is necessary for the development of certain parasitic fungi, but again there are some the spread of which is adversely affected by excessive soil moisture. Reaction of the soil also considerably affects the parasitic activity of a fungus. While diseases such as wilt of cotton and club-root of clovers are favoured by acidity, others like the flag-smut of wheat develop in alkaline soils. Available nutrition in the soil also has a profound effect on the existence and activities of a pathogen. Application of nitrogenous fertilisers has been found to increase the virulence of a disease and the use of phosphatic fertilisers to enhance the resistance of the host. Evidence on this aspect of the question as well as on the effects of other soil conditions on soil pathogen is, in general, not conclusive as contradictory results have been reported very frequently.

Among the Control Measures devised to prevent losses caused by soil-borne pathogens, there is no doubt that the most perfect method is the production and large-scale distribution of seeds of resistant varieties in a country like India where the growers are comparatively poor and cannot resort to expensive methods of control (the efficiency of which is often doubtful). The production of resistant varieties is a long-drawn process and is further complicated by the existence or appearance of physiologic races of the pathogens. Rotation of crops is often beneficial, as it starves out the fungus which requires a suitable host for its existence, but it is to be remembered that even long-term rotations have proved ineffective in certain cases. Sterilization of soil by heat and chemicals is often recommended for the control of soil-borne diseases. Sterilization of soil by heat is not practicable on a large scale and, wherever carried out, it has been frequently found that if the pathogen is introduced afresh from an outside source, it does greater damage than in unsterilized soil which contains generally a large saprophytic

* Summary of the Presidential Address of Dr. R. S. Vasudeva, delivered before the Section of Agriculture, during the 36th session of the Indian Science Congress, held at Allahabad, Jan. 1949.

flora. Sterilization by chemicals has not been found to be effective on a field scale, as a good penetration into the soil is generally not obtained. Biological control offers a good means of preventing soil-borne diseases. Starving out the pathogen or eliminating it altogether by enhancing the antagonistic activities of the non-pathogenic micro-organisms has been found to be possible by modifications of cultural practices or addition of certain manures as in the case of "Take-all" of wheat and potato scab. Field sanitation is another control measure which is often neglected to the detriment of the cultivator. Certain diseases like wilts are known to render fields unfit for cultivation and others like gram-blight perennate on crop refuse in the field. Debris from an infected crop should, therefore, be destroyed and not allowed to disperse. Rogueing diseased plants in the case of annual crops has not always been found to be beneficial, but has given good results in Plantations. Keeping the land fallow has also given good results in certain cases.

Amendment of soil conditions with a view to exeate unfavourable conditions for the pathogens has been tried with considerable success. Two striking examples are afforded by "Take-all" disease of cereals and root-rot of cotton. In the former case trefoil and Italian rye-grass are intercropped with barley. After barley is harvested in autumn the seeds-mixture grows actively and it is harvested in early winter and ploughed in. During its period of growth the mixture utilizes nitrogen essential for the "Take-all" organism and thus virtually starves it out. If the mixture is ploughed in, it gradually decomposes and liberates nitrogen for the next crop of barley. In the case of root-rot of cotton in the Punjab reduction in field temperature has been obtained by intercropping cotton with *moth* to control the disease. Changing the date of sowing has also proved very effective in controlling this disease. Adjustment of soil reaction by using such chemical substances as sulphur and lime has given successful results as in the case of potato-scab and club-root of clovers, but such methods are generally not practicable on account of the cost involved. Adjusting the soil moisture by giving proper attention to drainage and changing the depth of sowing has in some cases yielded good results, but cannot always be relied upon.

From what has been said about the behaviour of pathogens and control measures it is obvious that, while investigations carried out have cleared many obscure features, there are still more complex ones that require to be elucidated by intensive research involving radical changes in technique and methods of approach. It will be noticed that every one of the farm or garden crops is exposed to attack of some one or other types of soil fungi. The subject of soil pathology has gained importance during recent years. Having attracted the attention of pathologists it offers hopeful signs of solving the diverse pathological problems. For a proper study of these problems, team work of pathologists, soil-chemists, crop-physiologists, geneticists, and agronomists is what is imperatively needed.

SOME ASPECTS OF TUBERCULOSIS IN INDIA AND MEASURES FOR ITS CONTROL*

THE question of Tuberculosis is of vital importance to India at the moment; the defences of the cities against a disease like tuberculosis are yet weak and poor and the author insists that everything should be done to strengthen the defences.

In his Presidential Address, Dr. Soparkar, who has spent more than twenty-five years in the study of the various aspects of the disease both in man and animals, firstly deals with those aspects of tuberculosis which affect animals particularly cattle, because of its intrinsic importance from the agricultural and veterinary standpoint. The second part deals with the disease in relation to its control and eradication in India as it affects human beings.

* Abstract of Presidential Address delivered by Dr. M. B. Soparkar, before the Section of Medical and Veterinary Sciences, 36th Indian Science Congress, Allahabad, 1949.

Dealing with the tuberculosis among cattle, the author says that as a result of extensive survey it is found that the incidence of infection detected in India is about equal to that found in European countries where bovine tuberculosis is known to be prevalent and even exceeds those in some parts of Europe and America. The author says that if the incidence is based upon results of tuberculin test, it would probably reveal still higher incidence. The strains of tubercle bacilli isolated from cattle in India were found to be as virulent as those of European origin. The Indian cattle as a rule are not known to be infected under natural condition with tubercle bacilli of human type. The characters of the strains isolated were found to be of bovine type except in some isolated cases where the organisms isolated were found to be a mixture of bovine and avian types.

Although cattle are not as susceptible to infection with human type as they are with bovine type, yet they are known to be capable of harbouring this infection and of excreting these bacilli in milk without any gross lesion in the udder. This infection, therefore, if found on investigation to be prevalent among Indian cattle would constitute another source of danger to public health.

Besides cattle, several other species of animals suffer from natural tuberculosis. In the Zoological Gardens in Bombay the author found a large number of animals of different species including Llama, spotted deer, Nilgai, Sambar, antelope, Arabian gazelle, Malayan tapir, suffering from tuberculosis. In view of these findings and chronic course of the disease there is an obvious danger of infection to those who visit the gardens.

Taking up next the subject of the surgical form of tuberculosis the address refers to the meeting of the Second All-India Veterinary Conference held at Calcutta (1923). Major-General (then Colonel) Hutchison stated at the Conference that the so-called surgical form of tuberculosis such as bone and joint tuberculosis, glandular tuberculosis and other closed type of tuberculosis occur in India in the same proportion as in Western Countries and he laid stress upon the necessity of investigating the organism responsible for this form of human tuberculosis in India. The investigations carried out by Dr. Soparkar and others have shown that this type of disease is caused in India except in rare instances—mainly by the human type of tubercle bacilli. These and similar findings would appear to show that the bovine bacillus does not play an important role in the causation of human tuberculosis in India in spite of the high incidence now recorded of the disease among cattle. This is mainly perhaps because of the almost universal practice of boiling milk. Nevertheless a potential danger would remain.

Referring to experiments on immunisation against Johne's disease caused by an acid-fast bacillus closely allied to tubercle bacillus, the address says that intravenous inoculation of cattle with living avian tubercle bacilli has been used for the purpose of prevention. The results of Dr. Soparkar's experiments in this connection suggest the possibility of averting the fatal effects in cattle following upon intravenous inoculation of avian tubercle bacilli, by previous treatment of the animals by subcutaneous method, thus rendering safe the method of preventive inoculation of cattle against Johne's disease by the application of living avain tubercle bacilli.

Discussing the nature of allergic reaction in tuberculosis the paper states that results of experiments have demonstrated the presence of a toxic product and afford a direct experimental proof in support of the hypothesis that in apparently normal skin of tuberculous animals certain substances are present which, when brought in contact with tuberculin, render it toxic so that an inflammatory reaction is produced.

As regards the existence of a filterable form of tubercle bacillus, the author carried out several experiments, and obtained evidence of the existence of a filterable form, probably representing a stage in the evolutionary cycle of the organism.

Turning to the immediate practical problem of the control of tuberculosis in man, the author first deals with the available data regarding the prevalence of tuberculosis in India. He then goes on to discuss the expenditure involved in providing adequate number of beds for the isolation and treatment and after-care of cases, a means adopted in Western countries where the control measure has made good progress. Such measure in India would involve an enormous sum of money which the country under the present circum-

stances can hardly afford. The whole scheme cannot be implemented at once even if funds are available and it will take time before the disease can be controlled to any appreciable degree by adopting this measure. In the meanwhile something must be done and the author suggests that the only solution to the problem appears to be mass immunisation. The method which has been of late widely adopted is preventive vaccination with B.C.G. Experience of over ten million vaccination with B.C.G. has demonstrated the safety and harmlessness of the measure and the protection it affords. After discussing protective value of B.C.G. vaccination and the effect of this vaccination on general infant mortality, the author points out that the Ministry of Health, Government of India, after careful consideration, have come to the conclusion that mass vaccination with B.C.G. will be a cheap and effective method of control. It has been decided to introduce this method at first on a limited scale in a few large centres in the country under the supervision and control of the Central Government.

In conclusion, the author stresses upon the need for further research in this direction and urges the authorities to launch a campaign for the mass vaccination with B.C.G. Given the will and the drive, it will be possible, with proper organisation, the author remarks, to give protection to millions of the population and thus bring this disease under control. N. N. De.

THE PLACE OF PHYSIOLOGY AMONGST THE MODERN SCIENCES AND THE IMPORTANCE OF ITS STUDY TO THE NATION*

DR. SARKAR in his Presidential Address has described Physiology as the study of the normal working of the delicately adjusted systems and of the various factors belonging both to the internal and the external environments, which influence and modify their activities. The importance of physiological knowledge for the health and welfare of individuals and the nation as a whole is universally recognised. Physiology therefore should be a special subject of study and research. Dr. Sarkar has indicated a few lines along which we should proceed to improve and develop the study of physiology and intensify research in the subject.

Discussing the claim of physiology for being considered as an independent science, the author says that as an independent subject of study, it rests on the tripod, Morphology, Physics and Chemistry. He emphasised that in our country Physiology has to be viewed and fostered as a fundamental subject of importance. It should be developed on proper lines like other important science subjects. It is true that the growth of physiology is inseparably connected with that of medicine. But physiology is not a branch of medicine though it forms one of its principal basic subjects. And as such it forms the solid foundation on which the clinical knowledge is built up. Therefore, the systematic study of physiology should be continued with advantage during the subsequent years in the clinical classes and post-graduate studies in medicine.

Dr. Sarkar suggests that when there are plans for improvement of education for the proper training of high class scientists and technicians in this country, immediate steps should be taken for carefully preparing plans for the improvement of medical curriculum. All the outstanding results of modern progress should be included in the study and it is not a bad idea as Dr. Sarkar points out to provide additional course of study in physiology of a higher standard.

Acknowledging the importance of the study of physiology as advancing our knowledge regarding the working capacity of man under various conditions of stress and strain imposed by modern civilisation, the author says that proper arrangements should be made for training scientists in the theory and practice of some of the highly specialised technical branches of physiology. With this object in view it has to be decided whether physiology should find a place in School and College curriculum. The author sees no reason why elementary physiology should not be introduced in schools as a compulsory subject of study. It should also be included

* Abstract of Presidential Address delivered by Dr. B. B. Sarkar before the Section of Physiology, 36th Indian Science Congress, Allah abad, 1949.

in the graduation course and post-graduate study encouraged.

Dealing with researches in physiology Dr. Sarkar goes on to say that extensive research must be undertaken not only for the development of the subject but also for the solution of many urgent problems for the benefit of mankind. Researches in fundamental physiology are the bases on which Applied Physiology will grow and develop and the many problems on the applied side such as physiology of growth and development, physiology of reproduction, of regulation of body temperature, aviation physiology, physiological effect of radiation, industrial physiology, etc., call for immediate attention. Plans for future progress in all directions should be instituted so that posterity will benefit most from these investigations. Another problem which is very urgent is the solution of nutritional problem which is confronting people in every sphere of life all over India. It will be the duty of the physiologists and the nutritionists to study the nutritional requirements of the people and the biological food values of available material and to devise a physiologically suitable diet from them.

The author concludes by saying that India will need a large number of well-trained physiologist to tackle her innumerable problems and the Department of Physiology will be required to supply these workers. This is only possible, the author points out, by treating physiology as an independent science subject of great importance. Dr. Sarkar appeals to all the physiologists to put their heads together, to prepare carefully plans for inaugurating and stimulating higher studies and extensive researches in physiology. He also appeals to the Government, the Universities and the learned scientific bodies to give their serious attention to this essential matter and help to develop this important science.

N. N. De.

OBITUARY

JAMES HORNELL, 1865–1949

THE recent death of Dr. James Hornell in England has caused profound regret in India particularly among the fishery workers.

After a brief service in Ceylon in connection with investigations on Pearl Banks initiated by Professor W. A. Herdman, Hornell joined the Madras Fisheries Department as Marine Biologist in 1915. In 1918 he took over charge of the Directorate of Fisheries from Sir Frederick Nicholson. Though he could not put through many of his schemes on account of financial difficulties caused by the war of 1914-18, his regime was marked by conspicuous progress on all aspects of fisheries. Among some of the contributions of Hornell are the initiation of fisherics research, establishment of biological stations at West Hill, Krusadai and Ennore, a technological station at Tanur and of a fish cannery at Chaliyam, reorganisation of the chank fisheries, fish curing yards, the aquarium and the maintenance of fishery statistics and the initiation of welfare work amongst fishermen such as general and technical education and co-operation. He retired in 1923 after a distinguished record of service.

From 1924 onwards he was engaged by the Colonial Office in England to study and reorganise fisheries in Palestine, Malta, West Africa and Fiji. He took an active part in a number of fisheries conferences and meetings including the Colonial Fisheries Conference held in England in 1946.

His contribution to the fishery literature is rich and varied. The *Madras Fisheries Bulletins* published by him are invaluable guides to fishery workers. His recent book "*Water Transport*" is a great contribution on the crafts of different parts of the world. The excellent pioneer work of Hornell in the field of fishery development and fishermen welfare will be long remembered in this country.

K. C.

LETTERS TO THE EDITOR

ON $\tau(n)$ MODULO 49

A careful study of my "Table of Values of $\tau(n)$" for values of n up to 400, has led me to the

Conjecture: If p be a prime of the form $7q + r$, where $r = 3, 5$ or 6

then

$$\tau(p)/7 \equiv r - 1 - [3/r] - 2q \pmod 7,$$

where $\tau(n)$ is Ramanujan's function and $[x]$ denotes as usual the greatest integer in x. It may be noted that

Lehmer's Conjecture: If p_1 and p_2 be primes congruent modulo 49 and $\left(\frac{p_1}{7}\right) = -1$,

then $\tau(p_1^{\alpha}) \equiv \tau(p_2^{\alpha}) \pmod{49}$, $\alpha \geqslant 1$, would follow readily from my conjecture and the well-known result

$\tau(p^m) = \tau(p)\,\tau(p^{m-1}) - p^{11}\,\tau(p^{m-2})$, $m \geqslant 2$.

Government College, Hansraj Gupta.
Hoshiarpur,
January 5, 1949.

Gupta, H., "Table of Values of $\tau(n)$," *Proc. Nat. Inst. Sci., India*, 1947, **13**, 201-6. Lehmer's Conjecture was conveyed to me by R. P. Bambah in a recent letter.

HARMONIC ANALYSIS AND EXPERIMENTAL DATA

The chief characteristics of yields of most of the perennial and tree crops in successive years are the presence of cyclic changes and trends, great variability in the yields of plants in the same year and the correlation between the yields of the plants in successive years. Such trends, cyclic changes, variability and correlation in the data are common in experimental data of some other branches of studies such as economics, biology, etc.

The characteristics mentioned above offer some difficulties in the study and interpretations of experimental data and in obtaining conclusive results from experiments. Inconsistent results are at times obtained by applying the usual methods of the analysis of variance for the data of individual years or experiments. Orthogonal polynomials have been frequently used to represent trends in the experimental data. But they are unlikely to be of much use in representing the nature of trends mentioned earlier.

One of the methods, which appears to be satisfactory, would be to represent the data by a multiple regression equation of the

type $y_t = bt + A\cos\frac{2\pi t}{T} + B\sin\frac{2\pi t}{T} +$ constant,

where y_t = Yield for year t

b = linear regression coefficient

A and B = Fourier constants of the harmonic. Trends of higher order like parabolic etc., may also be represented by adding terms like $Ct^2 + dt^3$, etc., to the above equation.

This is illustrated by taking yield data of a perennial crop for 9 years, which exhibited certain definite trends, cyclic changes and random variations. Application of orthogonal polynomials gave the following analysis of variance.

Source of variation	d.f.	M.S.
Deviation from mean ..	8	2711
Linear regression ..	1	8874
Quadratic ..	1	523
Cubic ..	1	399
Quartic ..	1	622
Quintic ..	1	4608
Deviations ..	3	2221

These have removed a certain portion of the variation in the series, periodogram analysis with trial periods of 2, 3, 4 and 5 years showed that the energy of the third harmonic is maximum. This harmonic is

$$7{\cdot}3\cos\frac{2\pi t}{3} - 46{\cdot}13\sin\frac{2\pi t}{3}.$$

Tests of significance as developed by Schuster modified by Walker and finally by Fisher can be applied. The extent to which the harmonic will represent the data may be examined by finding the reduction in the variance of the series after removal of the cyclic changes. Nearly 50% of the total variation can be explained by the harmonic.

The variation in yield can be more completely represented by the multiple regression equation

$$y = 10{\cdot}68 - 3{\cdot}37\cos\frac{2\pi t}{3} - 39{\cdot}96\sin\frac{2\pi t}{3}$$

assuming that the cyclic changes are represented by a 3-year cycle. The analysis of variance would be

Source of variation	d.f.	M.S.
Regression ..	3	5326
Deviation ..	5	1140

The level of significance is near 5%. Thus, it would be possible in any experiment to examine and see if the regressions have been influenced by the treatments and if they differ from plot to plot. It is probable in some cases, the amplitude varies with time suggesting existence of damped harmonics.

More details on this will be appearing elsewhere.

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ON THE INVESTIGATION OF π AND μ MESONS

EXPERIMENTS performed in Rome by Dr. Conversi, Pancini and Piccioni[1] on the interaction of mesons with matter have revealed the interesting fact that positive mesons decay in iron while the negative ones do not and are presumably captured by the nuclei. On the other hand, all the mesons—both positive and negative, decay in carbon; few could be captured by the nuclei. These results were later confirmed by Valley and Rossi (M.I.T.)[2] by much more elaborate apparatus incorporating both Wilson cloud-chamber and counters with delayed circuit.

This difficulty of weak interaction of the mesons with nuclei may be resolved if we assume that there are fundamentally two types of mesons with different masses.[3] The lighter mesons which we observe at sea level are in fact produced as a result of the spontaneous decay of the heavier mesons that are formed at greater heights by proton primaries. This postulate appears to be confirmed by Powell and Ochhialini in Bristol[4] by the photographic method. These workers call them μ and π mesons respectively. μ meson is the light meson of non-interacting type and π meson is the heavier interacting type. This hypothesis (of interacting and non-interacting types) refers to π^- and μ^- mesons, π^+ and μ^+ meeting always the same fate, *i.e.*, suffering β decay.

The most probable height of formation of mesons was shown by Euler and Heisenberg[5] while explaining absorption anomalies to be 16 km. above sea level. This has been confirmed by A. Duperier[6] from the consideration of temperature effect.

Now if these are taken to be π mesons in the terminology of Powel and Ochhialini, they will give birth to μ mesons during their flight. As the height of formation of mesons mentioned above is only the average value and there is a large layer of definite thickness in which mesons are formed, the limit up to which π mesons will retain their identity will, like the height of formation of π mesons, be not sharp and will have a finite thickness. The observations taken with increasing heights will, therefore, show relatively increasing number of π mesons (as shown by Powell's observations—this increase is due to the fact that at lower heights some of the π mesons have decayed into μ mesons, and also due to the increasing number of the primary radiation responsible for the production of π mesons), till we reach a limit where there will be no μ and only π mesons. In order to determine this height photographic method is not so suitable, as high mountain peaks with regularly increasing heights will have to be selected, in order to give long exposures to the plates. As an alternative, Dr. Conversi's apparatus with iron plates magnetised to concentrate negative mesons could be sent to greater heights. The height at which maximum interaction, indicated by a minimum number of decay electrons recorded in this apparatus, can be taken to be height of formation of μ mesons. Besides verifying the hypothesis of interacting and non-interacting types of mesons, it will give the thickness of the layer of formation of mesons.

Observations at sea level with Dr. Conversi's appartatus do not present any difficulty due to the soft component, as cosmic rays at sea level consist mostly of mesons. At greater heights some device of cutting away the soft component will have to be incorporated along with the above apparatus, in order to work with only mesons and to have unambiguous results. If the usual absorbing screens of lead are used, the amount of lead required may become prohibitive for observations at greater heights. We may, instead, have Bhabha's[7-8] device of cutting away the soft component by splitting a very much less thickness of absorbing plate into two appropriate parts in the ratio of approximately 1 : 4. The thinner one, which corresponds to the thickness for the maximum of the Rossi curve, is used to produce showers and thicker one to absorb the shower particles.

The writer wishes to express his thanks to Dr. R. C. Majumdar, Head of the Physics Department, Delhi University, Delhi, for the useful discussion on the subject.

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THE GEOMAGNETIC EQUATOR

RECENT literature on the subject of terrestrial magnetism reveals that there is some confusion in the understanding of the term "Magnetic Equator", as it can be considered from two points of view—first from a knowledge of the dip angles (this being zero on the magnetic equator); and second from calculations based on the assumption that the earth's magnetic field is best represented by a small but powerful magnetic dipole at the geometrical centre of the earth. The latitudes determined by measurements of dip angles are designated "Magnetic Latitudes" and those calculated on the basis of the dipole theory are called "Geomagnetic Latitudes". Many workers seem to think that the two are identical while some make this distinction.

The measurements of polarisation of radio waves carried out at Huancayo where dip is 2° 10′ S, by Wells and Berkner[1] show that the ordinary and extraordinary rays are plane polarised as demanded by theory. This result leads to the view that it is the geomagnetic equator which counts and not the magnetic equator, so far as ionospheric work is concerned.

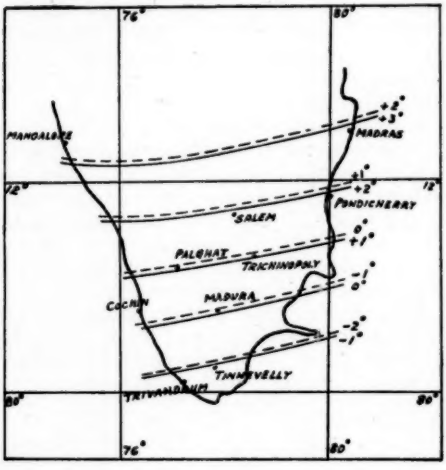
Appleton[2] first showed that for noon equinox conditions F_2 critical frequencies plotted against dip angles give symmetrical curves about the magnetic equator

with maxima at 28° N. and S. Appleton[3] and later, Liang[4] have replotted the F_2 ionisation densities against geomagnetic latitudes in place of magnetic latitudes. From these curves it can be safely concluded that it is more reasonable to use geomagnetic latitudes rather than the magnetic latitudes for the determination of the geomagnetic control over the ionosphere.

The apparent divergence between the magnetic and geomagnetic latitudes may be explained as follows. The geomagnetic potential V is made up of two parts V_e and V_i

$$V = V_e + V_i,$$

where V_e and V_i are parts of external and internal origin respectively. Bauer[5] in his spherical harmonic analysis of the earth's field has shown that the field of internal origin forms 94% of the total field; the field of external origin being 3% and a non-potential part N due to earth air currents being 3%. The measurement of inclination is governed by local conditions and it represents the entire field while the dipole theory takes into account only the 94% of the total field. Although the divergence between the magnetic and geomagnetic latitudes is not much, it is there in principle and has to be considered.



A precise knowledge of the geomagnetic equator is hence necessary for those engaged in work on ionosphere, cosmic radiation and geophysical problems. To suit their needs McNish[6] has published nomographs from which the geomagnetic co-ordinates can be read off for any terrestrial point. The geomagnetic co-ordinates of any place can be calculted from the following equations:—

$$\tan x = \cos(\lambda - \lambda_0) \cot \phi$$
$$\tan \wedge = -\tan(\lambda - \lambda_0) \sin x \sec(x + \phi_0)$$
$$\tan \Phi = -\cos \wedge \operatorname{Tan}(n + \phi_0)$$

where λ_0, ϕ_0 are the co-ordinates of the geomagnetic pole; λ, ϕ are the geographical co-ordinates of the place and are $\wedge, \Phi$ the geomagnetic co-ordinates of the place. x is the auxiliary angle. These calculations have been performed on the assumption that the earth's magnetic field is represented by a dipole at the geometric centre of the earth.

Later, it[7] has been shown that a still closer approximation to the earth's magnetic field is given by assuming it to be due to a dipole displaced 342 km. from the earth's centre towards a point in longitude 162° E. and latitude 6°·5 N., with its axis parallel to the line through the centre of the earth and the geomagnetic pole. Bartels has shown that the eccentric dipole gives a truer picture of the observed field than the centred dipole, especially in the equatorial region.

According to Vallarta[8] this asymmetry in the magnetic field is fully competent to account for the observations of clay, Alfven, Milikan and Neher on cosmic radiation. Also Heisenberg[9] has clearly stated that the magnetic centre does not coincide with the earth's centre.

The author has calculated the geomagnetic latitudes for about 50 places in South India, both for the centred and the eccentric dipole, using the equations given above. It was found from the analysis of the 1945 data that the co-ordinates of the geomagnetic North Pole are 78°·7 N. and 289°·9 E. in place of the earlier values of 78°·5 N. and 291°·0 E. The latest figures have been used in the present calculations; for the eccentric dipole the co-ordinates of the geomagnetic North Pole are 80°·1 N. and 277°·3 E.

The geomagnetic latitudes have been drawn at intervals of 1° (unbroken lines refer to centred dipole and the broken lines refer to eccentric dipole) in the map given in the preceding column.

The geomagnetic equator for the eccentric dipole agrees with Vallarta's results, and it is suggested that the eccentric dipole

field is to be taken into account when geomagnetic latitudes are required for work in the Indian Reigion.

The author is indebted to Dr. A. K. Das, Director, for his helpful criticism.

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February 12, 1949.

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STUDY OF THE CONDITIONS OF PRECIPITATION OF CUPRIC HYDROXIDE FROM CUPRIC SALTS BY SOLUBLE HYDROXIDES

Part II. Role of Hydration in Determining the Chemical Character of the Hydrated Oxide

IN Part I of the series,[1] we have determined the composition of the precipitates obtained by the interaction of cupric sulphate and sodium hydroxide in different proportions. It has been observed that the association of sulphate with the precipitate varies remarkably with the concentration of alkali used. The precipitate of hydrated cupric oxide has a tendency to retain more of sulphate in the adsorbed state when the amount of alkali used is less than the theoretically equivalent quantity. An account of the results is presented in the following table.

TABLE I

Concentration of cupric sulphate = 4·805 mgM. in 10 c.c. of the mixture

Temperature 30° *C.*

Alkali added in mgM.	Composition of the precipitate
9·833	CuO
9·636	59 CuO, SO_3
9·439	47 CuO, SO_3
9·243	24 CuO, SO_3
9·046	16 CuO, SO_3
8·849	12 CuO, SO_3
8·653	9·6 CuO, SO_3
8·456	7·3 CuO, SO_3

It has been observed that besides the variation in the physical character of the precipitate, the solubility of the precipitate in ammonia solution also changes remarkably. A sample precipitated using an excess of sodium hydroxide is totally insoluble in ammonia solution. The formation of cuprammonium complexes from the oxide seems to be determined by the sulphate present in it and also by the amphoteric nature[2] of the hydrated oxide. The dissociation of cupric hydroxide can be repesented as:

$$Cu(OH)_2 + = Cu(OH)^+ + OH' \quad \ldots (1)$$
$$Cu(OH)^+ + = CuO + H^+ \quad \ldots (2)$$
$$H^+ + OH' = H_2O \quad \ldots (3)$$

In equation (1) the basic character of the oxide is predominant, as the liberated OH' seeks protons, *i.e.*, H^+. In equation (2) $Cu'(OH)^+$ behaves as a proton donor, thus leading to the formation of water as denoted by equation (3). Thus the CuO left will be chemically inert being produced by the neutralisation of the acidic and the basic properties of cupric hydroxide. A similar phenomenon has been reported by Dey and Ghosh,[3] who suggested the same mechanism in hydrated ferric oxide to explain the growing insolubility of the oxide with age.

The amount of water associated with cupric oxide, when precipitated with different quantities of alkali has been determined. Two samples of hydrated cupric oxide using different quantities of alkali have been prepared. Water associated with the oxide is recorded in the table below:

TABLE II

Preciptations carried out at 30° *C.*

Ratio of copper to alkali	Composition of the precipitate
1 : 2·00	3·09 CuO, H_2O
1 : 2·10	5·74 CuO, H_2O

It is thus seen that the quantity of alkali employed for precipitation has an appreciable influence on the hydration of the precipitate. Samples with lower concentrations of alkali were not studied as they were found to be contaminated with large amounts of sulphate. It was further observed that ageing for a month had no perceptible effect on the hydration of cupric oxide.

It is therefore obvious that besides the variance in the quantity of sulphate associated with cupric oxide, hydration of the

oxide decreases with an increase in the quantity of alkali used for precipitation. This hydration ultimately affects the chemical properties of the oxide.

Further work on hydroxides is in progress, and the results, it is hoped, will throw considerable light on such phenomena.

The author thanks Dr. S. Ghosh of the University of Allahabad for his kind interest.

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VANADAMETRY—PART II

Volumetric Estimation of Ferrocyanide Ion by Sodium Vanadate

FERROCYANIDE ion is oxidised in acid solutions readily to ferricyanide ion by a number of reagents, *e.g.*, hydrogen peroxide, potassium permanganate, dichromate, chlorate, bromate, iodate, chlorine, bromine, iodine, ceric sulphate, etc. Many years ago De Haen[1] proposed the estimation of ferrocyanide by titration with potassium permanganate. Muller and Lauterbach[2] adopted the same reaction for electrometric titration. Kolthoff[3] proposed an iodimetric method based on the reaction between ferrocyanide and iodine in neutral solution. Schwicker[4] adds an excess of potassium iodate solution to the acid solution of the ferrocyanide and estimates the unreacted iodate by titration with a decinormal potassium bisulphite solution.

Recently Gopala Rao and Viswanadham[5] and Gopala Rao and Ramanjaneyulu[6] have found that sodium vanadate provides an excellent oxidimetric reagent which possesses some special advantages over potassium permanganate and potassium dichromate. We have now made experiments to see if sodium vanadate could be successfully employed for the volumetric estimation of potassium ferrocyanide. 5 mls. of 0·05 potassium ferrocyanide solution were taken into a beaker, diluted to about 150 ml. with distilled water and acidified with 10 ml. of about 15 N sulphuric acid. The solution was titrated with 0·05 sodium vanadate solution, using 0·5 ml. of diphenyl benzidine solution as an internal indicator. At the end point, the colour changes from a pale green into a blue violet. We found that the colour change is sharply noticeable only when the overall acidity of the solution is above normal and the concentration of the ferrocyanide is not more than N/600. If the concentration exceeds this limit the solution must be suitably diluted. From the results tabulated below, it will be seen that the method gives accurate results under the conditions prescribed.

Amount of potassium ferrocyanide, $K_4Fe(CN)_6 3H_2O$, in milligram mols.

By weight	By permanganometric titration	By vanadometric titration
0·2679	0·2682	0·2678
0·5358	0·5365	0·5356
0·8037	0·8047	0·8033
1·0716	1·0704	1·0712
1·3395	1·3417	1·3390
1·6074	1·6071	1·6092

We have also found that the estimation of ferrocyanide by vanadate can be accurately carried out even in the presence of hydrochloric acid, oxalic acid, etc., where permanganate fails. Details are communicated for publication elsewhere.

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A STUDY OF *CERCARIA FRASERI* BUCKLEY, 1929 IN MADRAS

IN the course of an investigation of the life-histories of some trematodes, a diplocotyle amphistome cercaria was found to issue from specimens of *Indoplanorbis exustus*, first on 15th September 1941 and

on many occasions subsequently, from various localities in the vicinity of Madras. The structural details which determine its taxonomic position are the heavy pigmentation, the presence of well-defined oral pouches, and independent lateral excretory canals showing dichotomy at the anterior ends. The rediæ are of the characteristic type with three pairs of flame-cells, but no locomotor appendages, and contain a second generation of rediæ, or cercariæ. When we had recourse to previous studies on this group of cercariæ, we found it possible to distinguish our form from all those of the Diplocotylea described hitherto, except *Cercaria fraseri* which Buckley (1939) obtained from the same species of snail in Assam, India, although the recurrent branch of each lateral excretory canal figured by this author is not always to be seen.

In a recent communication, Peter and Mudaliar (1948) remark erroneously that only two diplocotyle cercariæ—*Cercaria Indica* XXI Sewell, 1922 and *Cercaria kylasami* Rao, 1932—have been reported from India. Unacquainted with the literature on the subject, they further believe that their larva is new, which is not so. The characters given by them are precisely those which mark *C. fraseri*, according to Buckley's description and our own observations as well, and it is beyond doubt that they have been dealing with only *Cercaria fraseri*.

Experiments have been conducted to augment our knowledge of the biology of these cercariæ, their discharge from the snails, their encystment and behaviour in relation to environmental conditions, their association with other known amphistome cercariæ, their distribution in and away from Madras, and their host-specificity. They seem to be selective, like *Cercaria Indica* XXVI, in their intermediate host, as on no occasion was *Limnæa* from the same tanks ever observed to harbour them. *Cercaria Indica* XXVI, the larval form of *Cotylophoron cotylophorum* has been found to be a frequent associate of *C. fraseri*.

In an attempt to obtain their adults, 5083 encysted cercariæ (*C. fraseri* and *Cercaria Indica* XXVI) were administered to a he-buffalo calf on 8th March 1946, and over 20,000 to a pigling on 16th May 1946, expecting that *C. fraseri* might grow into *Homalogaster poloniæ* in the calf or *Gastrodiscoides hominis* in the pig. Daily microscopical examination of the fæces of both was made, and since no evidence of infection in the pigling appeared it was discharged on 21st Nov. 1946. But, in the calf which had been stall-fed for many months, trematode eggs were first seen on 12th July 1946 (4 months 4 days later) and at autopsy on 11th Nov. 1946, nearly 2,000 adult amphistomes were recovered from the rumen. A small proportion of them when examined proved to be *Cotylophoron cotylophorum*, apparently grown from *Cercaria Indica* XXVI. The negative result in both animals, in so far as *C. fraseri* is concerned, is in accord with that obtained by Buckley (1939).

Buckley (1939) considers it unlikely that its adult might be *Gastrodiscus secundus*, in view of its differences from the cercaria of the nearly related species *G. ægyptiacus*. Looss (1896) draws attention to the presence, in the cercaria of *G. ægyptiacus*, of an œsophageal bulb, a distinctly different pattern of the excretory system in the body, of external pores for the excretory canal in the tail, and of locomotor appendages in the younger rediæ, all of which are absent in *C. fraseri*. If these considerations have any significance against the adult of the latter being *G. secundus*, the only other equine amphistome with oral pouches—but lacking an œsophageal bulb and commonly met with in Madras is *Pseudodiscus collinsi*.

Parasite	CERCARIA		REDIA
	oral pouches	œsophageal bulb	locomotor appendages
Gastrodiscus agyptiacus	present	present	present
Zygocotyle lunata ..	present	present	absent
Cercaria fraseri ..	present	absent	absent
Cercaria frondosa ..	present	absent	present

Ecological factors favour yet another line of argument. The frequent occurrence of *C. fraseri* in companionship with *Cercaria Indica* XXVI (the larva of *C. cotylophorum*) in the same, or in different, specimens of *Indoplanorbis exustus*, and occasionally with *Cercaria Indica* XXIX (the larva of *Fischœderius elongatus*) in *Limnæa* from the same tanks, strongly suggests that its host may also be a domestic ruminant. This possibility is further supported by the

record of *C. fraseri* from a tank of the Hosur Cattle Farm which could have been visited only by cattle, sheep or goats among the large animals. However, this cannot eliminate the possibility of a parasite of monkeys, aquatic birds or lower water vertebrates occurring in such places, since these hosts could contaminate even confined waters. In that event, the adult parasite is probably a Cladorchid amphistome of the kind that has pharyngeal pockets without an œsophageal bulb.

In the light of these conflicting evidences, and of the misleading observations made on *Cercaria Indica* XXVI before it was proved to be the larva of *C. cotylophorum*, it would seem expedient to conduct carefully controlled experiments for determining the adult of *C. fraseri* conclusively.

This preliminary discussion will be published in detail elsewhere.

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LIFE-HISTORY, BIONOMICS AND CONTROL OF SWEET POTATO WEEVIL—*CYLAS FORMICARIUS* F. IN BOMBAY PROVINCE

SWEET POTATO is regarded an important vegetable both because of its keeping quality and its food value. Of 12,928 acres under sweet potato in Bombay Province (1946–47) about 55% of the area is concentrated in the districts of Belgaum, Satara and Sholapur only. Of the various pests, namely, *Aspidomorpha miliaris* F., *Diacrisia obilqua* W. and *Cylas formicarius* F., attacking this crop the last one is a major pest, which is very widely distributed and causes great damage to the sweet potato tubers as well as to the mature stems.

Systematic investigations on this pest therefore, were started in 1947 at Padegaon Research Station with a view to studying its life-history, bionomics and control since its damage seemed quite alarming and information of any practical utility was not available in this country. The incidence of attack by this pest to the tubers alone extended upto 59·9% in an area where the crop was repeatedly grown. Apart from the damage done to the tubers, the weevils cause considerable damage to the mature stems of the vines within which the larvæ tunnel and arrest the vigour of the plants. The average number of developed stages per foot of the draws of the vines, varied from 1·5 to 3·3 while the maximum number of developed stages found in a single tuber of the dimensions 16·5 × 4·3 cm. was 65 out of which 44 were larvæ, 11 pupæ and 10 adults.

The nature and extent of damage, the life-history and the seasonal history have been studied and some of the control measures tried. Experiments to study the effects of manuring and irrigation on the relative infestation of the pest indicated that with somewhat heavy manuring and irrigation at an interval of 7 days, the percentage of infestation in the tubers was 3·02 which was the lowest as against the highest percentage of 17·2 in the plots with normal manuring and delayed irrigations at fortnightly intervals. The percentage of infestation with normal manuring and normal irrigation of 10 days' interval was 8·7. The incidence of attack in relation to other cultural treatments as date of sowing and spacing, etc., was also studied and on the whole, the red variety of sweet potato seems to be more susceptible to weevil attack than the white one.

The duration of life-cycle may occupy 23 to 45 days with the egg-stage lasting for 5–10 days, the larval stage 14–24 days and the pupal stage 4–11 days. The longer durations however, are met with in winter. The pest breeds throughout the year and deposits its small, oval, whitish eggs singly, both in the mature stems and within the tubers when they are formed. The larvæ and pupæ are found both in the stems and tubers. The freshly emerged adult weevil stays for a couple of days within the larval tunnel before it comes out. Usually the males outnumber the females and their percentage throughout the year vary from 53·4 to 67·0. No alternate host-plant has been recorded

even though wild species of *Ipomœa* have been mentioned as host-plants in other countries.

Preventive methods of control such as the use of healthy setts for planting, deep rooting varieties and destruction of adults by chemical or mechanical means are of practical importance. Preliminary insecticidal trials with Gammexane and Hexyclan (BHC group) have yielded encouraging results in the control of the pest and the results are being confirmed.

The detailed information regarding our investigations will be published separately.

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STUDIES IN THE STORAGE OF GUR

IN a previous communication (1949), the authors described a successful method of gur storage under a blanket of ash. While constituting a considerable improvement over current methods, storage under ash was associated with some loss in weight of gur and although highly suited to village conditions, it might possibly be considered a rather drastic departure from existent practice in markets. Experiments were therefore undertaken with the object of devising suitable moisture-proof wrapping materials or containers for storage. Twenty-five such (comprising various kinds of coatings on paper, cloth, gunny, earthenware, etc.) were under examination, the properties of gur samples in each being periodically studied as described earlier (*loc. cit.*). Ash storage was the basis of comparison.

The undermentioned methods proved effective in maintaining the product in good condition throughout storage:

I. Storage of blocks wrapped in paper coated with (*a*) Paraffin wax, (*b*) Mixture of paraffin wax and coconut oil (2:1), (*c*) Mixture of paraffin wax and castor oil (2:1).

II. Storage of blocks in closed dealwood box lined with paper coated with paraffin wax.

III. Storage of blocks stitched in gunny bag coated with white (zinc oxide) paint.

IV. Storage of blocks in furnace ash.

Of the above methods, I (*a*) had been reported to have shown satisfactory results in preliminary experiments conducted at the Indian Institute of Sugar Technology, Kanpur (private communication) and was included in order to test its utility under the more humid conditions at Pusa. Methods I (*b*) and I (*c*) were modifications of the same, aiming at reduction in cost.

It would appear from the list of effective methods that paper coated with paraffin wax is a suitable wrapping material and a mixture of wax with an oil (2:1) also

TABLE I

Showing statistical comparison of properties of Co 313 gur under different methods of storage

(Figures are means of the whole storage period. Detailed data omitted for brevity)

Method No. / Characters 1	I(*a*) 2	I(*b*) 3	(I *c*) 4	II 5	III 6	IV 7	Conclusions 8
1 Sucrose per cent.	76·25	78·12	78·60	79·35	78·47	80·50	CD at 5% = *0·92*, *CD at* 1%=1·23 At 5%: *IV II I(c) III I(b)* I(*a*) At 1%: IV *II I(c) III I(b)* I(*a*) Highly significant.
2 Glucose per cent.	4·35	4·72	4·86	3·96	4·86	3·48	CD at 5% = *0·43*; *CD at* 1%=*0·58*. At 5%: (III I(*c*)) *I(b) I(a)* II IV At 1%: (III I(*c*)) I(*b*) *I(a) II* IV Highly significant
3 Moisture per cent.	5·13	5·80	5·41	4·93	5·83	4·35	CD at 5% = *0·40*; *CD at* 1% = 0·53 At 5% : III *I(b) I(c) I(a) II* IV At 1% : III I(*b*) *I(c) I(a) II* IV Highly significant
4 Millieq. acid in 100 g.	19·34	19·55	19·97	19·34	20·63	18·01	CD at 5% = *0·68*; CD at 1%=0·91 At 5% : III *I(c) I(b) I(a) II* IV At 1% : III *I(c) I(b) I(a) II* IV Highly significant

serves the purpose. Gunny bags coated with white (zinc oxide) paint are suitable containers and cheap coats of similar nature might prove useful.

It was observed that while ash storage permitted of no deterioration in colour, there was considerable darkening in the other methods. A satisfactory level in respect of chemical criteria was maintained in all cases, although ash storage manifested a distinctly superior trend (Table I). On the other hand, no weight losses were recorded in any of the new methods, as opposed to losses of 11-12 per cent under ash storage.

As compared to ash storage, these methods are necessarily expensive and need to be adapted for commercial application. While their economics require detailed examination, the observations recorded here are of interest, as containing the germ for development. Further studies are in progress.

This work was done as part of the Sugarcane Research Scheme in Bihar, being financed jointly by the Government of Bihar and the Indian Central Sugarcane Committee, to whom grateful thanks are due. The assistance rendered by Mr. K. S. Bandyopadhyay in statistically analysing data presented here is also acknowledged.

Central Sugarcane Research Station, Pusa,
January 23, 1949.

K. L. KHANNA.
A. S. CHACRAVARTI.

1. Khanna, K. L., and Chacravarti, A. S., *Proc. Ind. Acad. Sci.*, 1949, **29**, 3.

CRUDE COMMON SALT AS A FAIRLY GOOD SOURCE OF DIETARY CALCIUM IN THE CASE OF SOUTH INDIANS

ON analysing a specimen of a basal South Indian rice diet,* representing the average consumption per subject per day, in connection with some human metabolism experiment, it was observed that it contained about 0·8 gm. of calcium. This high value of calcium was much more than expected as the various ingredients chosen for the diet were of low calcium content. To account for this high calcium content, all the ingredients of the diet were analysed for calcium and it was found that crude common salt was responsible for this. 50 gm. of the salt were added to the diet to make it tasty; the calcium supplied by this quantity of salt alone being about 0·3 gm.

The normal intake of common salt is about 12 gm. per day; but in South India, an adult consumes about 50 gm. of crude common salt which he takes mainly in spicy preparations like vegetable soup (*Sambar*), *Rasam*, and *Uppuma*. It was therefore of much interest to see how the subjects keep themselves in calcium balance with such a high intake of calcium from the common salt and also to compare the results with those of the subjects receiving refined salt.

Six healthy adult human subjects were used for the experiment. Each subject received the diet, the composition of which is mentioned above. The quantity of food served to each subject was the same during the two periods assuring the same caloric intake. *Uppuma*, a common South Indian preparation of rice flour was served to each person during both at breakfast and at tea time and cooked rice with *sambar* and vegetable curry was served during lunch and dinner. Each experimental period lasted for seven days; the first three days were observed as a preliminary period, and the urine and fæces of the subsequent period of four days were collected quantitatively. There was a rest period at one week between the two successive feeding periods.

Data on calcium balance are expressed in mg. per day

Subject	Calcium metabolism with crude common salt					Calcium metabolism with refined salt				
	Food* calcium intake	Excretion			Balance	Food† calcium intake	Excretion			Balance
		Urinary	Fæcal	Total			Urinary	Fæcal	Total	
H.M. ..	790	162	395	557	+233	501	178	351	529	−28
J.C. ..	„	174	473	647	+143	„	135	313	448	+53
M.D. ..	„	131	444	575	+215	„	194	322	516	−15
H.B. ..	„	145	571	716	+ 74	„	143	301	444	+57
K.B. ..	„	192	382	574	+216	„	144	315	459	+42
B.B. ..	„	183	632	815	− 25	„	153	396	549	−48
	Average ..				+142	Average ..				+10

* Calcium supplied by 50 gm. of crude salt alone being 0·301 gm.

† Calcium supplied by 50 gms. of refined salt alone being 0·04 gm.

Calcium in the food, salt and fæces was estimated by the method of McCrudden.[1] Urinary calcium was measured according to the method of Shohl and Pedley.[2] The data on calcium intake excretion, and balance are given in the above table.

From the above data it is seen that in the case of crude salt, all the subjects excepting one, are on the safe side of positive calcium balance with an average of +142 mg. balance, while in the case of refined salt three out of six subjects show negative balance, the average calcium balance being only +10 mg.

These findings show that the crude common salt is a useful source of calcium and can partly supplement the South Indian rice diet which is deficient in that essential mineral.

The various samples of crude salt have been analysed by us for the calcium content, the calcium content varies from 0·48—0·72 gm. per 100 gm. of the salt.

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Bangalore,
January 27, 1949.

* The composition of the diet was 675 gm. of polished rice ; 40 gm. thur dhal ; 10 gm. Bengal gram ; 200 gm. vegetables, *i.e.*, potatoes, brinjals, onions ; 1 oz. of groundnut oil ; and *a small amount of spices, tamarind* and *chillies* (Tamarind 25 gm., dry chillies 12 gm. and other spices 10 gm.)

1. McCrudden, F. H., *Jour. Biol. Chem.*, 1911-12, **10**, 187. 2. Shohl, A. T., and Pedley, F. C., *Ibid.*, 1922, **50**, 537.

COMMERCIAL D.D.T. AS AN INSECTICIDE ON SUGARCANE CROP

D.D.T. (Dichloro-diphenyl-trichloro-ethane) as sold in the market is dissolved in kerosene oil or its emulsion with water and is intended primarily for use against mosquitoes and other domestic insect-pests such as cockroaches, bed-bugs, etc. Recently some firms have put for sale their own brand and claim beneficial effects for them against certain crop insect-pests such as leaf-hoppers. Early in September last, one such preparation diluted with water to 0·3% concentration was used against pyrilla on sugarcane at Motipur (District Muzaffarpur). A week after spraying, distinct chlorotic spots were visible on the lamina and midribs all over the sprayed area. The leaf material showing these discoloured spots where the liquid had accumulated into droplets and dried up, was preserved in Formalin-Acetic-Alcohol.

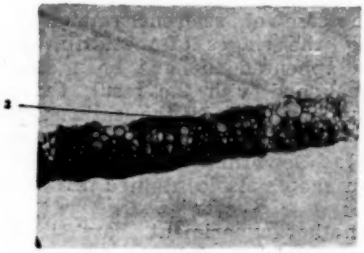

FIG. 1

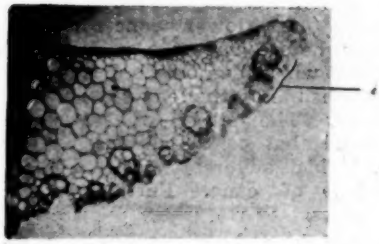

FIG. 2

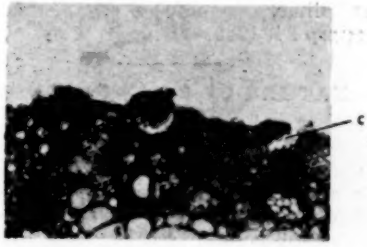

FIG. 3

FIG. 1. T.S. of lamina showing disruption of epidermis which is intact at *a* (× 60)

FIG. 2. Part of T. S. of midrib showing extensive disintegration of tissues. Blackish substance is present in Xylem vessels and in parenchymatous cells at *b* (× 40).

FIG. 3. Part of T.S. of midrib showing the weakening of middle lamella as indicated by regular tearing away of cells at *c* (× 250).

Hand sections (Figs. 1 and 2) through these spots showed that liquid affected the plant tissues adversely, both in the lamina and the midribs. The lumen of long cells

of epidermis in the affected area was occupied by opaquely black substance insoluble in water, alcohol and xylol. The neighbouring cells containing chloroplasts were similarly affected, and in some cases xylem and phlœm were rendered functionless as they were choked by this substance. In the case of sclerenchymatous cells forming the ridges of a midrib, middle lamella appeared to have been considerably weakened with the result that they were unable to hold the cells together while the material was being sectioned (Fig. 3). Sometimes these cells of the vascular sheath also contained this blackish matter.

In another experiment carried out at Motihari (District Champaran) where stock solution of D.D.T. dissolved in a mixture of turpentine and toluene, was diluted to 0·2% and lower concentrations with water before use as a remedial measure against white fly, no such discoloured spots were visible on the leaves even after four weeks. The study of juice attributes showed that concentrations higher than 0·2% had adversely affected the sucrose content of cane. Further work is in progress.

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S. L. SHARMA.

February 24, 1949.

NATURE OF BOND IN IONIC CRYSTALS

IT is usually assumed that the bonds in the crystals of alkali halides are 100% ionic. This view has been based on the alleged additive relationships existing in the internuclear distances, molar refraction, diamagnetism, binding energy, &c.

A detailed examination of the data on the above properties will however reveal the marked departure from the law of additivity.

In the present paper we have shown that the data on the crystal energy is completely in agreement with the partial ionic nature of the bonds in the crystals.

The energy of the crystal has been calculated by Born and co-workers by applying the equation $U = A\left\{\frac{e^2}{r}\left(1-\frac{1}{n}\right)\right\}$, where A is Medelung constant, r is the internuclear distance. The values of n, the repulsion coefficient, vary from 6 to 12.

It has been pointed out by the present authors (see previous note) that the energy of a bond A–B is the sum of ionic $i\frac{e^2}{r}$ and covalent $(1-i)\sqrt{D(A-A)\,D(B-B)}$ energy. The energy of the bond in the crystal should be given

$$U = A\left\{i\frac{e^2}{r} + (1-i)\sqrt{D(A-A)D(B-B)}\right\} \quad (1)$$

where U is the observed crystal energy, A is the Madelung constant.

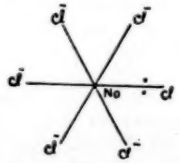
Following table gives the results for the ionic character calculated from crystal energies by using equation (1).

Bond	Crystal Energy	Distance		Ionic character	
		Crystal	Gas	Crystal	Gas
NaCl ..	180·4[P]	2·81[M]	2·51[M]	0·83	0·64
NaBr ..	171·7	2·98	2·64	0·86	0·64
NaI ..	160·8	3·23	2·99	0·86	0·45
KCl ..	164·4	3·14	2·79	0·85	0·74
KBr ..	157·8	3·29	2·94	0·86	0·70
KI ..	149·0	3·53	3·23	0·86	0·71
CsCl ..	153·2	3·56	3·06	0·91	..
CsBr ..	149·6	3·71	3·14	0·93	..
CsI ..	136·1	3·95	3·41	0·90	0·74

P—Pauling, *The Nature of the Chemical Bond.*
M—Maxwell and Mosley, *Phys. Rev.*, 1937, **52**, 968.

Discussion.—The ionic character in crystals is systematically higher than the gas values owing to increased internuclear distance r. A plot of i against r^2 shows that the ionic character is directly proportional to r^2, *i.e.*, dipole moment is proportional to r^3, *i.e.*, to polarisability.

The partial ionic character in the crystal can be explained quantitatively on the basis of covalent-ionic resonance in a unit $NaCl_6$. [*cf.* Pauling, *Nature of the Chemical Bond*, p. 72]. In the structure



in which a sodium atom is surrounded by six chlorine atoms, it will not form more

than one covalent bond. Hence the average ionic character of each bond will be 5/6, *i.e.*, 83% which is in good agreement with the values (83—86%) calculated from the partial ionic character of bond energies. Similarly in the case of cœsium chloride each cœsium being surrounded by eight chlorines and forming one covalent bond the partial ionic character should be 7/8=0·875 which compares favourably with the values. ·91, ·93 and ·90 for cœsium chloride, bromide and iodide respectively.

A further support to the partial ionic character of alkali halides comes from the data on magneto-optical anomaly (Faraday effect) of these salts found by Darwin and Watson (1927), ($r = 0·8$) and recently by Ramaseshan (1948), ($r = 0·85$) and from the dielectric constants and dipole moments as shown by us in a previous note.

Indian Inst. of Sci., S. K. KULKARNI JATKAR.
Bangalore 3, (MISS) S. B. KULKARNI.
March 5, 1949.

1. Darwin and Watson, *Proc. Roy. Soc.*, London, 1927, **114A**, 474. 2. Jatkar and Kulkarni, *Curr. Sci.*, Under publication. 3. Ramaseshan, *Proc. Ind. Acad. Sci.*, 1948, **28A**, 360.

IONIC CHARACTER OF HYDROGEN AND ALKALI HALIDES

THE object of the present note is to point a remarkably simple relationship between the internuclear charges and ionic character.

The dipole moment of hydrogen halides in gaseous state as measured by Smyth and Zahn are in agreement with the measurements of dielectric constants of pure solids, liquids and solutions by using a new equation as shown elsewhere. The experimental values of the ionic character are 0·43, 0 17, 0·11 and 0 05 for HF, HCl, HBr and HI respectively.

Table I shows that relationship between ionic character of hydrogen and alkali halides as given by $\frac{Z_A}{Z_A+Z_B} \times n$ where Z_A, Z_B are the nuclear charges and n is a screening constant which is 8/8 for CsF and increases to 8/3. The calculated ionic character of HF (0·267) while in agreement with the bond energy data is lower than the observed value 0·43.

The dipole moments of alkali halides in vapour state have been determined by the molecular beam method. Scheffer's values are $\sqrt{3}$ times lower than those obtained by Rhodebush. No data is available for NaCl and NaBr in vapour state. The calculated values of ionic character $(Z_A/Z_A+Z_B) \times n$ seem tobe in good agreement with ionic characters obtained from Rhodebush's data. In view of the fact that Cs is the most electro-positive and F is the most electro-negative of all the elements, the high value 0·86 for CsF is quite reasonable and is in agreement with the value 0·91 assigned by Smyth.

TABLE I

Ionic Nature of Hydrogen and Alkali Halides (Gases)

Bond	Distance	$\frac{Z_A}{Z_A+Z_B}$	n	Ionic nature	
				cal. $\frac{Z_A}{Z_A+Z_B} \times n$	obs. $\frac{\mu}{e.d}$
HF ..	0·92	0·100	8/3	0·267	0·43
HCl ..	1·28	0·0557	,,	0·149	0·17
HBr ..	1·43	0·0278	,,	0·074	0·11
HI ..	1·62	0·0183	,,	0·049	0·052
NaCl ..	2·51	0·393	8/6	0·64	..
NaBr ..	2·64	0·239	8/3	0·64	..
NaI ..	2·90	0·174	,,	0·45	0·35[S]
KCl ..	2·79	0·528	8/6	0·71	0·70[R]
					0·47[S]
KBr ..	2·94	0·350	8/4	0·70	0·77[R]
KI ..	3·23	0·264	8/4	0·71	0·71[R]
					0·44[S]
CsF ..	2·60	0·859	8/8	0·86	0·58[Hu]
					0·91 Smyth
CsI ..	3·41	0·509	8/6	0·68	0·74[R]

P—Pauling, L., *The Nature of the Chemical Bond.*

S.—Sheffers, *Phys. Zeit.*, 1934, **35**, 425.

R—Rhodebush, *J. Chem. Phys.*, 1936, **4**, 372.

Hu—Hughes, H. K., *Phys. Rev.*, 1946, **70**, 570.

Ind. Inst. of Sci., S. K. KULKARNI JATKAR.
Bangalore 3, (MISS) S. B. KULKARNI.
March 5, 1949. S. N. GOPALASWAMY.

BOND ENERGY AND IONIC CHARACTER OF HYDROGEN AND ALKALI HALIDES

A STRONG support to the values of the ionic character of bonds should naturally come from bond energy data. Considerable amount of work has been done on this

subject using the empirical electronegativitydata of Pauling.

It is well known that the energy of a bond between unlike atoms is greater than the energy of a normal covalent bond between these atoms. According to Pauling the arithmetic mean or preferably the geometric mean of the bond energy values D (A–A) and D (B–B) is the energy of the ideal normal covalent bond between the atoms A and B. The *additional* bond energy $\Delta AB = D(A-B) - \frac{1}{2}\{D(A-A) + D(B-B)\}$ was taken as the *additional* resonance energy due to the *extra* ionic character of the bond. In the present paper we have calculated the bond energy based upon the partial ionic character $\Delta i = D(A-B) = (1-i)\sqrt{D(A-A)\cdot D(B-B)}$ $= i\frac{e^2}{r}$ where $\frac{e^2}{r}$ is the Coulombic energy.

In Table I the values of Δi are calculated by using the theoretical ionic characters given by $i = \left(\frac{Z_A}{Z_A + Z_B}\right) \times n$ which are close to the observed (*cf.* previous note).

TABLE I

(A) *Bond energies of homopolar bonds*

Bond	Energy$_P$	Bond	Energy$_P$
H–H ..	103·4	I–I	35·4
F–F ..	70·0	Na-Na	18·4
Cl–Cl ..	56·9	K-K	12·6
Br–Br ..	45·2	Cs-Cs	10·1

(B) *Bond energy and partial ionic character*

Bond	Distance r_P	Energy $D(A-B)_P$	i (cal.)	Ionic binding energy	
				cal. $i\frac{e^2}{r}$	obs. Δi
HF ..	0·92	147·5	0·267	96·0	91·0
HCl ..	1·27	102·7	0·149	38·0	37·0
HBr ..	1·41	87·3	0·074	19·0	24·0
HI ..	1·61	71·4	0·049	12·0	14·0
NaCl ..	2·51	97·7[Pi]	0·64	85·0	87·0
NaBr ..	2·64	88·5[H]	0·64	81·0	76·0
NaI ..	2·90	72·9[H]	0·45	52·0	55·0
KCl ..	2·79	101·4[Pi]	0·71	83·0	97·0
KBr ..	2·94	91·3[H]	0·70	87·0	89·0
KI ..	3·23	78·9	0·707	71·0	73·0
CsF ..	2·60	131·9	0·86	110·0	128·0
			0·91 Smyth	116·2	129·5
CsI ..	3·41	75·0[Sp]	0·68	72·0	70·0

P—Pauling, *The Nautre of the Chemical Bond.*
Pi—Pitzer, *J. Amer. Chem. Soc*, 1948, **70**, 2141.
H—Herzberg, *Molecular Spectra and Molecular Structure.*
Sp—Sponer., *Molekulspektren.*

The agreement between the results given in the last two columns is well within the uncertainties in the values of the bond energies.

Gen. Chem. Sec., Ind. Inst. of Sci., Bangalore 3, *March* 5, 1949.

S. K. KULKARNI JATKAR.
(MISS) S. B. KULKARNI.

ON RAPID VOLUMETRIC METHODS FOR THE ESTIMATION OF SILVER, BARIUM AND STRONTIUM IN AQUEOUS SOLUTIONS

Determination of Silver.—Though there are quite a number of methods for the quantitative determination of silver in aqueous solutions, a simple and rapid volumetric method has been described in this note. The method consists in the addition of a known excess of standard hydrochloric acid to a measured volume of silver solution, so as to ensure complete precipitation of silver chloride. Now, the excess of the acid remaining unused may be determined by titration against standard alkali solution using phenolphthalein as an indicator. The total amount of acid being known, the amount of hydrochloric acid reacted with silver ions may be found. The end point in this case is quite sharp and it has been found that the deviations in the results lie within permissible error. Since the solubility product of silver chloride is 1.5×10^{-10} at 25° C., and that of silver hydroxide at the same temperature is 2.2×10^{-8}, there are no chances of alkali being used up by silver chloride to form silver hydroxide.

Determination of Barium and Strontium.—A similar method can be used for the estimation of barium and strontium in aqueous solutions by employing sulphuric acid for precipitating insoluble barium or strontium sulphate. The excess of sulphuric acid reacted with barium or strontium can be known. In this case too, the possibility of any reaction between the insoluble sulphate and alkali is absent, because the hydroxides of barium and strontium are far more soluble than the sulphates. It has been observed that the results

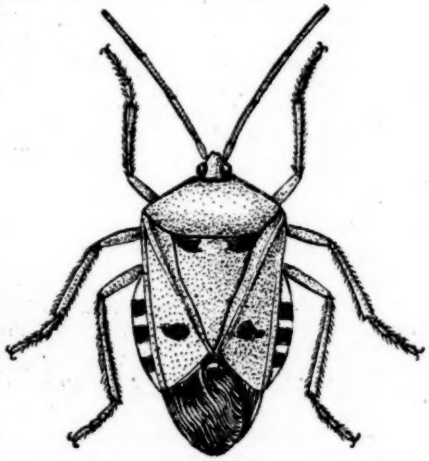
are quite satisfactory as found by actual determinations of these metals.

The principle involved in the above methods is well known and does not claim any originality. The methods are not intended to replace the standard methods, but can be profitably used in cases where rapid methods ensuring sufficient accuracy may be needed. It is suggested that similar methods may be applied for the volumetric determination of other metals also in aqueous solutions, which may be precipitated by acids or alkalies, remembering of course that adsorption does not play so important a role, as to interfere with the accuracy of the results obtained with the method.

Department of Chemistry,
University of Saugar, ARUN K. DEY.
November 22, 1948.

AN UNRECORDED INSECT PEST OF THE CASHEW TREE (*ANACARDIUM OCCIDENTALE*, L.) IN SOUTH INDIA

DURING the flowering and fruiting season of Cashew trees from November to May in 1946-47, a certain kind of bug was noticed in large numbers severely attacking Cashew trees growing along the West Coast, particularly of Travancore. As far as the writer is aware, there is no published record of these bugs on Cashew trees.



.Dorsal view of the bug

The bugs belong to the family Pentatomidæ of the order Rhynchota. Preserved specimens sent to the Government Entomologist, Coimbatore, were identified as *Catacanthus* sp. nov., very near *Catacanthus incarnatus* Dru. belonging to the same family. The figure shows the dorsal view of the bug. In the morphological characters these bugs resemble very closely of *Catacanthus incarnatus*, except for a few minor differences. *Catacanthus incarnatus*. Dru. is not known to occur on Cashew trees. Lefroy[1] mentions it as an unimportant insect from an economic point of view.

The bugs seem to prefer the very young fruits and embryonic leaves. They first hover round the bunch of fruits in order to select suitable site for feeding. They suck the sap and the tender resin by thrusting their long, pointed proboscis into the fruits. At a particular place they sit and continue to suck for about a period of five to ten minutes, after which they search for a different place to feed on. On an average one bug from early morning to about 10 a.m. was noticed to alight on nearly fifteen to twenty places and makes an equal or more number of punctures. Thus the innumerable bugs puncture all the fruits and tender leaves of a tree in a very short time. On an average 1,000 to 1,500 bugs were noticed on one tree.

As soon as the proboscis of the bug is withdrawn from the fruit, the ever oozing resin and sap flow out through the puncture. Since the resin is very corrosive, as it flows over the soft and tender parts of the fruit, it corrodes the green and smooth regions of the skin. The decay of the few superficial cells of the fruit favours the growth of harmful fungi. Thus the damage of the fruits which is started by the bugs is completed by the fungi attack. Though not seriously, the leaves are also affected to some extent as a result of innumerable punctures made by the bugs. The bugs, thus, are a menace to the Cashew planters, which are reported to bring down the yield of the Cashew trees to a great extent.

Full details on the habits and biology of the bug will be published elsewhere.

Agri. Research Inst., TRUPAPUR A. DAVIS.
Coimbatore,
February 16, 1949.

1. Lefroy Maxwell, *Indian Insect Life*, 1909, Part II.

PHOSPHORUS OXYCHLORIDE, A NEW CONDENSING AGENT FOR THE CHALKONE FORMATION

THE chalkones which serve as useful starting materials for the syntheses of flavones and related compounds, are usually prepared by condensing aromatic ketones with aldehydes in presence of a suitable agent such as hydrochloric acid[1] or alkali.[2]

In connection with our work on chalkones we observed that phosphorous oxychloride smoothly effected the condensation of acetophenone with benzaldehyde; the benzylidene acetophenone was obtained in good yields.

As this agent was not used before for this purpose, its applicability was investigated in several cases. It has been found that chalkones are formed in good yields from acetophenone, *o*- and *p*- hydroxy and *m*- nitro - acetophenones, using several aldehydes.

The general procedure is to add a few drops of the reagent to the mixture of aldehyde and ketone in equimolecular proportions. The reaction mixture after keeping overnight is decomposed with cold water and the separated chalkone is identified by a mixed melting point with a known sample.

The full details of this work will be published elsewhere.

M. R. Science Institute, G. N. VYAS.
Gujarat College, N. M. SHAH.
Ahmedabad,
December 17, 1948.

1. Claisen, L., and Claparede, *Ber.*, 1881, **14**, 2463.; Russel, A., and Clark, S. F., *J. Amer. Chem. Soc.*, 1939, **61**, 2655. 2. Claisen, L. and Ponder, A. C., *Annalen*, 1884, **223**, 137. For full references and work on Chalkones by Kostanecki, *vide Ber.*, 1912, **45**, 1701. Mahal, Rai and Venkatraman, *J. C. S.*, 1935, 866. Wheeler, *et al.*, *J. C. S.*, 1937-38, 1320, *et. seq.* Seshadri, *et al.*, *Proc. Ind. Acad. Sci.*, 1947, **26A**, 189.

ON THE FOOD OF THE GOONCH *BAGARIUS BAGARIUS* (HAM.)

THE Goonch is one of the largest siluroids occurring in the major rivers, into the upper reaches of which it migrates for spawning during the monsoons.[1] Its voracious and piscivorous habit is well known; and its teeth, thickwalled baggy stomach and intestines testify this.[2] Beavan[3] has observed this fish feeding on the Spiny Eel, *Mastacembalus armatus* and on the Herring, *Clupea chapra*. Chacko and Job[4] have recorded young prawns, fish remains and sand in the stomach of the young stages of the species. Analysis of the gut contents of over 100 adult specimens by me has revealed that 14 species of fishes, 2 of crustacea, and 2 of algæ, listed below, constitute the food of this species.

(1) *Labeo fimbriatus*, (2) *Cirrhina fulungee*, (3) *Osteochilus thomassi*, (4) *Catla catla*, (5) *Amblypharyngodon mola*, (6) *Barbus sophore*, (7) *Barbus stigma*, (8) *Nuria danrica*. (9) *Rasbora daniconius*, (10) *Barilius bendelisis*, (11) *Danio æquipinniatus*, (12) *Chela argentea*, (13) *Chelaphulo*, (14) *Macrones vittatus*, (15) *Palœmon malcolmsonii*, (16) *Palœmon scabriculus*, (17) *Spirogyra* and (18) *Cladophora*.

The marked piscivorous tendency of the Goonch may have an adverse effect on the other fluvial fisheries.

I am indebted to Mr. P. I. Chacko, Asst. Director of Fisheries, Madras, for his guidance and help during the investigation, and to the Director of Industries and Commerce, Madras, for according necessary permisson for the publication of the note.

Inland Fisheries Office, G. K. KURIYAN.
8, Ormes Road, Kilpauk,
Madras,
September 1948.

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REVIEWS

Supersonic Flow and Shock Waves. By R. Courant and K. O. Friedrichs. (Interscience Publishers, Inc., New York), 1948. Pp. 464. Price $ 7·00.

The theory of Supersonic flow and Shock waves is a very fascinating subject of recent development and research. A great deal of experimental work and theoretical investigation in this field may be found spread over a wide range of journals and technical reports, but till quite recently, there were very few books giving a connected mathematical theory of the subject.

The book under review is written by eminent theoretical physicists, who have themselves made important contributions to the principal mathematical methods required in such investigations as well as to the many specific topics such as flow through nozzles, the theory of deflagrations and detonations, formation and decay of shock waves and the interaction of shock and rarefaction waves. The book itself is a revised and enlarged form of an earlier report on the same subject.

The equations for flow problems in the dynamics of compressible fluids are formed with the help of the usual conservative laws of mass, momentum and energy. The changes of thermodynamic state are assumed to be adiabatic except at singularities, where modifications under suitable hypotheses are made. The general equations turn out to be non-linear in character and the aim of the mathematical theory is to solve such equations under given or appropriately formulated boundary and initial conditions. At present, only problems of special types are amenable to exhaustive mathematical treatment. While giving a thorough account of such problems, the book clearly reveals the imperfect state of the present theory and the need for further investigation relating to several aspects of flow problems.

The book consists of six chapters. The first two chapters furnish the necessary mathematical and physical background and a comprehensive treatment of one- and two-dimensional problems is given in Chapters III and IV respectively. Chapters V and VI deal qualitatively with three-dimensional problems under simplifying assumptions.

An outline of the contents of the book now follows.

In the first chapter the necessary thermodynamic notions are given in a suitable mathematical form and the general differential equations of flow are derived. The wave motion in shallow water which is analogous to the non-linear motion of gases is studied in the Appendix. In Chapter II the theory of characteristic curves and characteristics, the theory of simple waves and the method of hodograph transformation are described. The Appendix to this chapter deals with differential equations for functions of more than two independent variables. An exhaustive treatment of one-dimensional flow problems covering several aspects is presented in Chapter III. Rarefaction and compression waves, the formation of an envelope in a compression wave, shock discontinuities resulting from compressive motion are described. Shock wave theory is developed as an irreversible thermodynamical process caused by friction and heat conduction. Shock conditions are derived in several forms. Hugoniot function and Prandtl's relation for shock transition in polytropic gases are obtained. A qualitative description of elementary interactions is included. Collision of two simple waves is treated on the basis of Riemann's theory as well as by the more suitable method using finite differences. Chapman Jouguet reaction processes and hypothesis and Jouguet's rule are considered in some detail. The chapter ends with an Appendix on wave propagation in elastic-plastic material. In Chapter IV the hodograph method of solving special isentropic irrotational steady two-dimensional flow problems is used. Explicit formulæ for Mach lines, angles and cross lines are derived. The analysis of oblique shocks is carried out with the help of the shock polars. The interaction between shock fronts and production of regular shock and Mach reflections, the interaction of a shock and a simple wave are considered. Linearized perturbation methods for determining the flow around profiles are explained. Chapter V is devoted to a qualitative description of flow through nozzles and jets. In Chapter VI cylindrically symmetric steady flow against slender profiles, steady conical flow and non-steady flow with spherical symmetry are discussed.

The book is written in a clear and elegant style. It is profusely illustrated. The biblio-

graphy is extensive. There is a good subject index. The book is very stimulating and deserves to be widely used and appreciated.

T. VENKATARAYUDU.

Fundamentals of Physical Science. By Konard B. Krauskopf. (McGraw Hill Book Company, Inco. New York), 1948. Pp. 676.

The volume under review is a revised edition of the book which was first published in 1941. Many changes have been made in the present edition, namely, a complete rewriting of the chapter on atomic nucleus, addition of a section on the uncertainty principle, introduction of Bronsted's theory in the discussion of acids and bases and increased emphasis on air mass analysis in weather forcasting. A few sections of the first edition have been omitted or shortened because they did not contribute directly to the central theme of the book.

The author states in the Preface that the book is primarily meant for College students who wish to have a general knowledge of the physical sciences rather than a detailed knowledge of any one science. The four sciences of astronomy, physics, chemistry and geology, have been condensed in the book which runs to 650 pages only. It is therefore not surprising to find that many fascinating topics had to be omitted in each one of them while many others had to be touched only lightly. In presenting the subject, emphasis is placed less on the specific accomplishments of science than on how these accomplishments are made possible. The diffrent sciences are not treated separately, as the author wants to emphasise the unity of physical science as a field of knowledge rather than to stress its arbitrary divisions.

The book is divided into six parts, the division being based broadly on the different sciences dealt with in them. They are as follows :—(i) Astronomy and General Mechanics, (ii) General Physics and Early Chemistry, (iii) Modern Physics, (iv) Chemistry, (v) Geology and (vi) Astronomy and Frontiers of Physical Science.

Part I in which is treated the subject of astronomy with special reference to the solar system begins with a description of the efforts of early philosophers to gain an idea of the general structure of the Universe. This is followed by a detailed account of the accepted picture of the sun's family and the origin of the solar system. Fundamental problems connected with gravitational force and motion which are intimately related to the subject of astronomy are discussed in some detail and quite a few chapters have been entirely devoted for the same in Part I. These are followed by a chapter on energy which is included in Part II. The two succeeding chapters in Part II deal respectively with the three different states of matter, and the kinetic theory of gases. The progress of chemical knowledge during the 19th century is traced in the last five chapters in Part II. The third part is devoted entirely to cataloguing the many developments in physics which took place during the past fifty years, a topic which may be appropriately called modern physics. Many important branches of modern physics, *viz.*, x-rays, radio-activity, radiation, quantum theory, spectroscopy and nuclear physics, are very briefly referred to. In Part IV the author surveys a wide variety of chemical processes. The chemistry of carbon and silicon compounds and the colloidal state of matter have also been discussed in some detail. Part V is devoted to a discussion of the geological materials that are found on the earth and of the natural processes by which these materials are altered. The sixth and the last part is again devoted to the fascinating subject of astronomy. The universe beyond the earth is described here with special reference to the stars and galaxies.

The book is written in a simple style and is well illustrated. Mathematics has been very sparingly used. By stressing the methods of scientific reasoning rather than the results, the book attemtps to give to its readers a truer picture of the relationship of science to modern life and thought, better appreciation of the limitations as also the extraordinary power of the scientific method. Nevertheless, as the book covers a very wide field of knowledge, the reviewer feels that it may not be of much use to students undergoing a specific course in any one of the branches of physical science treated therein. It will, however, serve as a useful book for general reading.

R. S. K.

Outlines of Physical Chemistry. By Farrington Daniels. (John Wiley & Sons, Inc., New York ; Chapman & Hall, London), 1948. Pp. viii + 713. $5·00.

The teachers and the students of physical chemistry would receive with interest the publication of Professor Daniel's work. It is a completely revised form of the Getman and Daniel's older work which was regarded as one of the standard text-books on the subject in

America for more than thirty years, its last edition having been published in 1943.

In the preparation of the book under review the author has taken into consideration not only the immediate needs of the student preparing for the examination, but his greater requirements also, namely laying a sound foundation of the subject which may enable him later to devote his mind to its more complex aspects with a thorough understanding, an object very much to the heart of the teacher and the researcher alike.

In its twenty-one chapters, besides the usual subject-matter, the book deals with physical properties and molecular structure, heat work and heat capacity, phase diagram, quantum theory and atomic and nuclear structure—topics which give a sufficiently modern approach to a field wherein every new advance in the knowledge of physical and chemical sciences has left its indelible mark.

A large number of problems at the end of each chapter would undoubtedly provide the reader an insight into the laws governing molecular processes which have their importance not only in the field of pure and applied chemistry but also in apparently diverse fields such as engineering and biology.

A number of mathematical derivations which the author thinks could be 'taken for granted' by the 'hurried student', have been relegated to the appendix. At least some of these in the writer's view could have been incorporated in the text. Such are the evaluation of the constants in van der Waal's equation, calculation of distances between the planes in a crystal, the Carnot cycle, the rate equation, specific diffusion rate and the Bohr equation for the energy of an electron in an elliptical orbit.

Reference should be made to the careful selection of various diagrams and reproductions from photographs. These are always much to the point and references to them in the text have been made in bold types. This is a helpful feature which it should be always advisable to follow. The more uncommon and interesting among them are, atomic and molecular models giving correct interatomic distances and angles (this figure could have been made twice the size, with advantage), Hougen and Watson's chart for the calculation of pressure, volume and temperature of a gas at high pressure values, space models of several three component systems, Maxwell distribution of velocities of nitrogen pentoxide molecules showing the percentage of activated molecules at different temperatures, representation of relation between activation energy of forward and reverse reactions and the heat of reaction, chart for specific reaction rates at different temperatures for different activation energies and differential ('chromotographic') adsorption and elution of rare earths.

The 'Outline' thus provides from every point of view a desirable text-book which is eminently suited for adoption by our Universities.

B. K. VAIDYA.

Technique of Organic Chemistry. Vol. II. (Interscience Publishers, New York), 1948. Pp. 219. $5·00.

This is the second volume of the very valuable series on the Technique of Organic Chemistry, edited by Dr. Arnold Weissberger of the Eastman Kodak Research Laboratories. The first volume which was in two parts dealt with the Physical Methods of Organic Chemistry, and the present volume comprises chapters on Catalytic Reactions by V. I. Komarewasky and C. H. Riesz, Photochemical Reactions by W. Albert Noyes, Jr. and V. Boekelheide, and Electrolytic Reactions by Sherlock Swann, Jr. The theoretical background, procedure and apparatus employed in carrying out the reactions, their scope and limitations, a general bibliography and numerous references to specific topics are included in each chapter. The book is a link between the organic chemist and the chemical engineer, and will prove to be of the utmost assistance to research workers in both these fields who are concerned with catalytic, photochemical and electrolytic reactions and processes.

The chapter on catalysis contains useful practical details for the preparation of catalysts of different types (Raney nickel, copper chromite and vanadium pentoxide being notable omissions), and an excellent account of the procedure and laboratory apparatus for various catalytic reactions by batch and continuous methods and at pressures ranging from sub-atmospheric to several hundred atmospheres. High pressure technique is treated with a wealth of detail which will be invaluable to the organic chemist who desires to investigate high pressure reactions in general. The emphasis throughout is on apparatus and technique, and there are few references to individual substances prepared by catalytic reactions.

The chapters on photochemical and electrolytic reactions follow a somewhat different plan.

The treatment of technique and apparatus is less detailed, and more attention is devoted to the chemistry of the reactions. The types of photochemical reactions are classified and preparatory details are given for several compounds (*e.g.*, benzopinaconol, p-bromobenzyl bromide, di-*n*-propyl sulphide). The technically important photochemical rearrangement of ergosterol to calciferol receives, however, only very brief consideration. Chain reactions influenced by light such as photochlorination are described with citations of many examples, and the utility of photochemistry in organic synthesis is fully demonstrated. The chapter on electrolytic reactions covers the ground very thoroughly, and numerous examples of reactions of synthetic value are quoted. The advantages of electrochemical synthesis are set out and should serve as a stimulus for the wider use of electrochemical methods for the preparation of organic compounds as part of the programme of practical work in an Honours course in chemistry.

The indexing is unsatisfactory. Thus hydrogenation and reduction are not mentioned, although examples are given in connection with the preparation of catalysts.

K. V.

The Manufacture of Iron and Steel. By G. Reginald Bashforth, F.I.M. (Chapman & Hall), 1948. Pp. viii+228. Price 21*sh.*

The author has neatly covered in fair detail practically all the aspects of Iron production. The volume under review should therefore prove extremely useful to Metallurgy students. A typical feature of the book is the latest reference appended throughout the pages in support of the voluminous data condensed in the text.

The contents are neatly laid out and well balanced. Reference to Bihar and C. P. Hæmatites iron ore belts has not been made in relation to India's iron ore deposits although Mysore Magnetites deposits have been referred to. It may be pointed out the Bihar and Bengal iron ores of India form one of the richest iron ore deposits of the world. Further chapters deal effectively with the technical processes involved in Iron and Ferro-alloy's production.

The language of the book is precise and the information contained should prove useful both to the students as well as to a large measure to industrialists for reference study. The technical details of the processes involved are quite comprehensive. The pages on electric reduction of pig iron, however, lack adequate reference to the Swedish processes and their results. This may be ascribed to lack of space.

The book is a very useful addition to the metallurgical texts on Iron Production.

B. R. NIJHAWAN.

Chromosome Numbers of Northern Plant Species. By Åskell Löve and Doris Löve. (University Institute of Applied Sciences, Department of Agriculture, Reports, Series B, No. 3, Reykjavik), 1948.

The impact of other botanical sciences on plant systematics has been felt gradually since the beginning of this century. Plant geography has been one of these which has been of much help to taxonomy. The rapid development of genetics and cytology has thrown considerable light on speciation in plants and animals and the aid of these allied sciences appears to be very necessary if real differences between species have to be correctly established by taxonomists. The future taxonomist will, therefore, largely depend on results of cytogenetic investigations in the creation of new species or the delimitation of existing species. Information so far obtained by cytogenetic investigations on the interrelationship of species has been of considerable importance and it points to the future possibilities of gaining more information. There is thus both a scope and a necessity for undertaking work on the study of the interrelationship of taxonomic species from a cytogenetic angle. In this regard the publications of lists of chromosome numbers of plants has to some extent been of help to systematists among others.

The book under review lists the chromosome numbers of the plants of the Scandinavian countries and includes the higher flowering plants, gymnosperms and the pteridophytes. In a previous publication by the same authors the chromosome numbers of the flora of the four Scandinavian countries, *viz.*, Denmark, Finland, Norway and Sweeden were recorded but in the present publication the previous information has been amplified by the inclusion of the flora of the Færoes and Iceland. As the authors point out, "the present list is not only a list of chromosome numbers of the species met with in the area but is also a complete list of the floras of the six Northern countries". Thus the publication is of use to geneticists, cytologists and taxonomists.

On page 11 is given an interesting table

which furnishes information on the total number of species present in the six northern countries and the percentage of these cytologically determined. It is observed that a very high percentage varying from over 50 to 90 per cent. of the species of pteridophytes, gymnosperms and angiosperms have been cytologically studied. Another interesting information given is that more than fifty per cent. of the angiosperms of these areas are polyploids.

It would be of considerable help if similar lists of chromosome numbers of the flora of other geographical regions of the world, which would include the known floras of the area, are published.

The publication is most appropriately dedicated to Tischler who was the first to publish a list of chromosome numbers of plants. A key to the use of the publication, an index to synonyms, a bibliography and an index to genera are useful additions furnished.

L. S. S. KUMAR.

Dictionary of Genetics. Compiled by R. L. Knight. Vol. 2 of Lotsaya—A Biological Miscellany. (The Chronica Botanica Company, U.S.A.; Macmillan & Co., Ltd., Calcutta), 1948. Pp. ix+183. Price $4·50.

Under the editorship of Dr. Frans Verdoorn, the second volume of the series Lotsaya—Biological Miscellany has been issued. This volume is a Dictionary of Genetics prepared by Dr. Knight, Cotton Geneticist, Sudan.

The Dictionary is a comprehensive one, for, terms used in allied subjects, cytology, animal breeding and evolution, have been included. There has been no narrow adherence to these subjects alone, and terms used in animal embryology, and cytologically important chemical terms are included, making a total of about 3,000 entries. This is followed by brief appendices dealing with the formulæ of biometry important in genetics and plant breeding with six relevant tables.

There is a need for a dictionary of this type and in the Preface, the present confusion in terminology is pointed out. This book can be claimed to be a pioneer in this field, for generally the lists compiled by other geneticists have been brief appendices to a text. Dr. Knight has made good use of their compilation. For some of the important terms the definition is given and its author's name cited.

This Dictionary is not one which gives an explanation of new terms to a beginner, but one which tries to define the meanings with a view to greater precision in their use. A criticism of the definitions is difficult, as the terms are closely bound up with concepts and interpretations in this controversial subject. As an example the following may be pointed out. Strepsitene is termed a misnomer, according to Dr. Darlington, while chromonemata is defined as by Nebel, and Darlington's view is not presented. No simple solution is offered to the difficulty pointed out in the Preface that new words are being coined by research workers for which often the old ones will do, or which could be better constructed and defined. The remedy presumably is for the biologists to bestow greater care on the current usage. For this purpose, this Dictionary is a help and the author has done a service to geneticists.

C. G.

Biological Reactions caused by Electric Currents and by X-Rays. J. Th. Bander Werff, M.D., D.Sc. (Published by Elsevier Publishing Company, Inc., New York, Amsterdam, London and Brussels), 1948. Pp. xii+230. Price 30*sh.*

Biology is a science much younger than physics; therefore mathematico-theoretical developments in it have been until recently entirely lacking. During the last decade or two, considerable progress has been made towards the logical understanding of many observations which were known but ill understood. Using mathematical analysis and methods borrowed from mathematical physics, the science of mathematical biophysics plays the same role with respect to experimental biology and medicine as mathematical physics does with respect to experimental physics.

Such a book as the above is therefore welcome. It contains a theoretical study of the phenomena of excitation in the nerve by different electric currents and of the biological reactions in tissues caused by x-rays, both based upon a common principle. It is assumed that these cause changes in assimilation and dissimilation processes of metabolism, as a result of some disturbances. However, little further advance is to be expected unless more is known of these metabolic processes of life.

The theory described above has been useful in indicating the possibilities and limitations of x-ray therapy. Its most important result has been to unite the two fields in which so many investigators have spent their energy for so many years.

INDERJIT SINGH.

The Science of Animal Life. By A. M. Winchester. (Van Nostrand Co., New York; Macmillan & Co., London), 1948. Pp. xii+ 437. Price $4·50.

There is a general feeling among students that far too many technical terms abound in a study of biological sciences, a part of which at least one has to remember in pursuing a course in them. In order that the beginner may not be spirited away from a study of zoology, Winchester, in the book before us, has tried to avoid as far as possible the use of technical terms explaining, however, their meaning fully wherever they have been employed inevitably. Further, in order to evoke the maximum amount of interest in the student, he has portrayed the subject in an interesting manner.

There are 31 chapters including invertebrates, chordates, and general principles like genetics and embryology, and the book concludes with a glossary and an index. About half the book is devoted for the consideration of the invertebrates while the other half deals with chordates and general principles.

While perusing the book, it is noticed that in fig. 21·3 (p. 238) the olfactory and optic regions are labelled 'nasal foramen' and 'optic foramen' respectively ; these terms are inappropriate. Again, in the description of the frog's brain, it is not stated to which part of the original segmentation the diencephalon belongs. The figure of the alimentary system (p. 249) gives a wrong idea with regard to the hepatic duct which is shown independently of the pancreas.

Under aquatic vertebrates, the cyclostomes, elasmobranchs and other fishes are treated. The derivation of the term 'teleos' is misleading. It not only means 'perfect' but also 'end'; in defining 'teleostomi', it may not be justifiable to describe them as 'perfect mouthed' fishes as the author has done, but as fishes having mouth at one end. Undoubtedly the term 'teleostei' would mean fishes which are completely bony. Similarly, in the glossary, the term 'telolecithal' (p. 427) is explained as an egg showing uneven yolk distribution! Under reptilia, the figure (25·5, p. 284) representing the development of an embryo of a reptile or a bird, definitely conveys a wrong idea to the student ; the allantois is drawn as a double-walled bag completely enclosing the embryo.

In describing the snakes, the author has indulged in not a little folklore and on page 296, it is most amusing to read 'Unfortunately the majority of the people hold them in superstitious reverence and they do not kill them for fear that they may be the reincarnation of their late grandmother or other relatives'.

In the chapter on mammals, the fig. 27·1 (p. 325) is drawn to show the developing embryo of a mammal. In this it has failed, for the figure is not of a generalised type and further, the legend reads, that "the allantois has been replaced by the placenta" which is not at all correct.

There are a few printer's devils: 'righ' for 'high' (p. 262), 'Lepisosteus' for 'Lepidosteus' (p. 274) and 'an an exception', for 'an exception' (p. 326).

For a serious student of zoology, the book provides little food for thought, while it may satisfy the requirements of a beginner for whom the figures have been drawn, sacrificing the details. One must congratulate the author on the excellent photographs enlivening the book.

L. S. R.

Storing and Drying Grain—FAO Agricultural Studies No. 6.

Studies of methods used in Canada, the United States and the United Kingdom in drying grain before storage, have been released by the Food and Agricultural Organisation as a stimulus to the spread of information on protection of stored grain from insect and fungal attack. Great stress has been laid on the proper conditioning and storage of grain as the most important factors in preventing losses due to insects and fungi, at an international meeting on infestation of food stuffs held in London in 1947 where the loss was estimated at 33 million tons enough food to keep 150 million people alive for a year.

The methods used in these three highly industrialised countries, while far from ideal to all the countries, will, doubtless, be of help and interest to the other parts of the world.

Canada is very favourably placed in the matter of storing and handling grain because of the low temperature prevailing there throughout most of the year. The United States of America enjoys higher average temperatures and the humidity is also higher in many sections. Grain therefore faces greater danger from infestation and loss there than in Canada ; the moisture content of the grain must necessarily be lower for safe storage ; the diversity of the crops grown in U.S.A. also makes the problem more difficult.

The United Kingdom is faced with the two-

fold problem of handling and storing imported as well as home-produced grain.

In Canada and U.S.A. the extent to which Science is applied to the handling of cereal crops in the field, is most unusual to other parts of the world. The extensive use of the combine harvester in these two countries, while effecting great savings in labour, has created new storage problems, since, harvesting by combine, ordinarily leaves no time for the grain to dry out between cutting and threshing ; also the cutting of the green weeds with the grain, frequently results in the transfer of moisture from immature weed seeds to the drier grain kernels. The United Kingdom into which the combine harvester is now being rapidly introduced, has now to meet the increased demand for new methods and machines to cope with the new problems of grain storage.

The existing methods of handling, drying and storing grain described in the studies released by the FAO of the United Nations, are many and varied. Strict regulations concerning grain drying in the matter of the moisture content of different grain to be stored and maximum temperature of the hot air in drying grain artificially which are laid down and enforced are described. Results of experiments on the factors such as—effects of drying conditions on grain temperature and quality and the factor of different initial moistures—and minimum time required for safe drying under desirable and effective temperature are given in detail. The important part played by proper ventilation in safe storage in different kinds of bins is pointed out clearly and natural ventilation as well as that obtained by means of forced air are also dealt with. Useful information on Farm grain driers—Commercial grain driers—and grain drying in elevators—is provided. The national grain Silos in the United Kingdom established during the war as a contribution towards solving the problem of grain drying and bulk storage arising from the introduction of the combine harvester and the great expansion of wheat acerage, are pointed out as a great feature of the country, serving a useful purpose in setting high standards of drying and handling and in dealing with the wettest part of the crop in each year, since, without their being in operation, most of the grain handled by the ordinary and general silos in the country, would have been probably spoiled.

B. K. M.

SCIENCE NOTES AND NEWS

Fishery Research*

Fishery Research is the investigation of problems connected with the production and prop r utilization of the fish and other wealth from the waters. The first care of Fishery Research is that the areas concerned shall be fished right up to their fishable limit, but without harming the stock for future years. The investigations are therefore to be directed towards finding out not only the total productivity of the areas but also the correct type of fishing gear and the rate and frequency of fishing, as well as the details regarding the ecology, life-histories and the economic value of the different species of fish themselves. Such investigations provide the basis to evolve stocking policies and regulations for proper fishery management. The other part of Fishery Research aims at finding out suitable methods to preserve, cure, transport and store the fish and fishery products to ensure the best possible quality.

These investigations require the establishment of well-equipped and well-staffed biological and technological laboratories and seagoing research vessels. Large sums of money are being spent in this direction in all the advanced countries of the world. Japan, for instance, had more than 120 fishery research stations before the war; Russia has fifteen large fishery research vessels to-day; and the United States of America have added just last year a 525 ton vessel fitted with all the latest equipment, to their large research fleet.

In Indian seas, fishing is done only in the inshore regions which form a fraction of the 74 million acres of the continental shelf. Trawling experiments conducted off the coasts of Bombay, Bengal, Madras and Ceylon indicate greater possibilities for fishing the richer beds, but more

*Abstract of a Radio Talk, A.I.R., March 1949, by Mr. K. Chidambaram, M.A., F.Z.S., Assistant Director of Fisheries, Madras.

systematic research has to be carried out to gain a clearer knowledge of the fishing grounds by marine surveying, charting and hydrobiological studies. The Madras Government established the first Fisheries Department in India forty years ago and was later followed by several other Provinces and States and while some amount of work has been done by these Departments with limited personnel and finances, the Indian Fisheries are still in their infancy. Only recently, the Government of India have started biological research stations at Madras (Marine) and Calcutta (Inland) and have planned the establishment of a technological station at Bombay. It is desired that the latter would commence working soon. With effective co-ordination of fishery investigations and better appreciation and encouragement of fishery research among the various Provinces, States and the Centre, one can definitely anticipate an increased production and a proper utilization of the much needed nutritive food from the Indian waters.

U.N. Conference on Resources Utilisation

The United Nations Scientific Conference on Conservation and Utilisation of Resources, it is understood, will be scientific and not policy-making. The conservation and wise use of natural resources are problems of immediate concern to all nations. For the countries ravaged by war, these problems are very urgent as they must use the advanced techniques which will most rapidly bring their farm lands and factories to full productivity. For the highly industrial countries which are experiencing temporary shortages of some of their basic resources such as oil, coal and steel, there is good cause for concern over the rapidity with which they are consuming their stocks of irreplaceable materials. For India, the greatest interest lies in the utilisation of modern methods which will enable her to make sustained use of resources as yet untapped and to build up more productive and diversified economies.

Preventable and costly waste both of renewable and non-renewable resources is a world-wide phenomena. No country, however favoured, has yet succeeded in exploiting to the full the possibilities which the scientific utilisation of resources offers for a rapid advance in the standard of life. For such an advance the requisite methods and techniques are at hand or in a process of development. For some resources such as soils and forest, proven methods of conservation are available by which the bases of life can be restored, improved and preserved. For other types of resources such as metals, fuels and energy, new techniques have become available which promote rapid industrial development and enable the more effective use of scarce materials and thus help to increase the general well-being of the people. The range of new technological discoveries and their practical application is very wide. It ranges from the processing of low grade minerals to the development of insecticides that result in greater production of grains, cattle or cotton; from the utilisation of wood wastes to the winning of oil from wells; from finding minerals by new geophysical devices to techniques of preventing soil erosion, from producing rain from clouds to the creation of new animal and plant hybrids. The development of these advances in technique and administration is the work of many experts of the various nations throughout the world. No country has a monopoly of the best methods. Every part of the world has contributions to make and significant experience from which those are responsible have much to learn. The store of scientific and practical knowledge is one of the world's great resources. In this the world becomes a family. The fullest mobilisation of this knowledge is essential to equip the nations of the world for the task of raising and maintaining the living standards of their people. The United Nations Scientific Conference on the Conservation and Utilisation of Resources, it is hoped, is a step towards that mobilisation.

The Indian Delegation, it is hoped, will bring back to India from the Conference much useful scientific knowledge which will enable India to make use of the most modern scientific techniques in the various fields of industry and agriculture and will thus help to build up more productive economies which will raise the standard of living of the masses.

Recent Aadvnces in the Chemistry and Technology of Fats

In his Presidential Address before the Physical Sciences Section of the Ceylon Association of Science on "Recent Advances in the Chemistry and Technology of Fats", Dr. Child has briefly surveyed the methods of analysis and structure of fats based upon the publications of Baily (*Industrial Oil and Fat Products*) and of Hilditch (*Chemical Constitution of Natural Fats*).

Plutonium

For the first time Britain has produced plutonium the fissile element whic can be used for the creation of atomic power. This is one of the most important steps forward in Britain's atomic energy programme.

The plutonium was made at the Ministry of Supply's Atomic Energy Research Establishment at Harwell. It was extracted from a uranium slug which had been treated for several months in Gleep, the low power atomic pile. Because of the low power at which Gleep operates, the amount of plutonium is small, but it is sufficient for investigating the chemical and chemical engineering problems which will be met in the large-scale handling of plutonium.

Plutonium, which can only be produced in quantity in an atomic pile, does not exist naturally. It was first produced in quantity in 1942 in America and being fissile can be made to break up and give out great energy.

When the slug was unloaded from Gleep it was stored for sometime to ensure that the intense radic-activity decayed so that the experimental work could safely begin. When a uranium slug is taken out of a pile it contains, in addition to plutonium, some unused uranium and some highly radio-active products.

The separation of plutonium and unused uranium from the fission products is a difficult and complicated operation owing to the presence of many different radio-active elements. The final product is in the form of a solution of a plutonium salt.

Professorship of Eastern Religions at Oxford

Oxford University has been offered £42,000 (Rs. 5,60,000) to endow a Professorship of Eastern Religions and Ethics.

A Professorship in this subject has been established for some years on an experimental basis. Now, by the generosity of its founders, Mr. and Mrs. Spalding of Oxford, it can be placed on a permanent footing. It will also be possible to provide a travelling fund for the use of the professor who holds the post.

The founders make only one condition. It is that a permanent interest shall be built up in the University in the great religions and ethical systems of the East, whether expressed in philosophic, poetic, devotional or other literature. Its influence on art, history, social life and national structure is also to be studied. The aim is to bring together the world's great religions in closer understanding, harmony and friendship.

Its purpose will aiso be to promote co-operation with other universities, bodies and persons in the East and West pursuing like ends. It is considered that this is likely to be furthered by establishing a permanent professorship at Oxford. The post would normally be held by persons of Asian descent.

Anti-Rust Research

British scientists have just announced an important development in their experiments on the prevention of rust in metals. The discovery has been made at the Department of Scientific and Industrial Research.

During the war a solution of sodium benzoate was used for ensuring that water in car radiotors did not freeze in cold weather. It was also found that when added in small proportions to glycerine the mixture so obtained prevented corrosion of metal parts in the engine's cooling system.

It was then applied as an experiment to wrapping materials. Steel specimens so enveloped remained untarnished even when the wrapping was soaked with moisture.

Now a most promising development in these experiments has been disclosed. Sodium benzoate has been added to rubber latex and the resulting solution used for spraying bulky metal articles. These tests proved very satisfactory in giving complete protection from corrosion. Another advantage was that the spray formed a coating which could easily be stripped off when no longer required.

The new liquid preservative will be invaluable for protecting machined metal surfaces against rust during transport or when in storage.

Colorado School of Mines Scholarship

The Government of India have received information regarding the award of a scholar-

ship by the Colorado School of Mines, Golden, Colorado, U. S. A., to enable an Indian student to pursue studies in any of the following subjects: Mining, Metallurgy, Geology, Petroleum production and Petroleum refining, production and utilization of cements, refractories, clays and other non-metallic minerals. The scholarship is awarded annually beginning with the academic year 1949-50.

The scholarship which is renewable upto a maximum period of four years is of the value of $ 425/- to $ 475/- per annum which covers all tuition fees. It makes no provision for living or other personal expenses.

Candidates must be *bono fide* residents of India and must possess a good degree in science or engineering from any of the recognised universities in India.

Intending candidates must submit their applications in the prescribed form through their respective universities so as to reach the Ministry of Education, Administration, I North Block, Central Secretariat, New Delhi, by the 30th April, 1949.

Howard Medal—1948

Shri. K. N. Tandon, M.Sc., Research Assisttant in the Wood Technology Branch of the Forest Research Institute, Dehra Dun, has been awarded the Howard Medal for 1948 at the annual convocation of the Forest Research Institute and Colleges, presided over by the Hon'ble Pandit Jawharlal Nehru, Prime Minister of India. This award has been made to Shri. K. N. Tandon in recognition of his meritorious and original piece of research work on "The Study of the relation between height and diameter growth in some Indian forest trees".

Indian Chemical Society

The Secretary of the Indian Chemical Society is glad to announce that the Government of West Bengal has made a contribution of a sum of Rupees five thousand towards the preparation of the History of Chemistry in Ancient and Mediæval India (incorporating Sir P. C. Ray's History of Hindu Chemistry) undertaken by the Society. The Society has also approached the Government of India for a generous contribution for the same purpose.

Zoological Society of Bengal

The Third Annual General Meeting of the Zoological Society of Bengal was held on Sunday, the 27th March 1949, when the Secretary's report for 1948-49 and the audited accounts for 1948 were adopted. In his presidential address Prof. H. K. Mookerjee made a brief survey of zoological researches in the different parts of India and dwelt on the need of extensive and intensive research in various branches of Zoology from the national standpoint. He further laid special stress on the creation of a National Biological Laboratory sponsored by the Govt. of India. Also he appealed to the authorities of the Indian Association for the Cultivation of Science, Calcutta, for inclusion of research in biological sciences as one among its manifold activities of far-reaching importance. The following Office-bearers were elected for 1949-50: *President*: Prof. H. K. Mookerjee, D.Sc. *Vice-Presidents*: Dr. M. O. T. Iyengar, D.Sc., and Mr. K. N. Das, M.Sc. *Treasurer*: Dr. M. M. Chakravarty, D.Sc. *Hony. Secretary*: Mr. G. K. Chakravarty, M.Sc. *Hon. Asst. Secretary*: Mr. A. Guha, B.Sc. *Members*. 1. Dr. S. P. Ray Chaudhuri, Ph.D. 2. Dr. B. S. Chauhan, Ph.D., F.Z.S. 3. Mr. B. K. Mitra, M.Sc., F.Z.S. 4. Mr. J. N. Rudra, M.Sc. 5. Dr. N. G. Basu, M.Sc., M.B.

ERRATA

Vol. XVIII, No. 1, Jan. 1949, page 5, under References:

(i) *For* "3. Kalekar, H. M. ....."
read "3. Kalckar, H. M. ....."

(ii) *For* "8. Dounce, A. L., Rothstein, A., Beyer, G. T., Meier, R., and Freer, R. M., *Ibid*....."
read "8. Dounce, A. L., Rothstein, A., Beyer, G. T., Meier, R., and Freer, R. M., *Journ. Biol. Chem*....."

Vol. XVIII, No. 2, Feb. 1949, p. 43, Note on "Berek's Compensator";

Instead of log 14·55 and log 24·95 as given, the values of log $f(14{\cdot}55°)$ and log $f(24{\cdot}95°)$ should be calculated from the formula $\log f(i) = \log \{\sin^2 i\,(1 + {\cdot}2040\,\sin^2 i + {\cdot}0627\,\sin^4 i\}$ i being 14·55° and 25·95°.

Vol. XVIII, No. 3, March 1949, p. 74, column 2, line 15.

Note entitled "P-cymene from carenes", *for* O-derivative *read* m-derivative.

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